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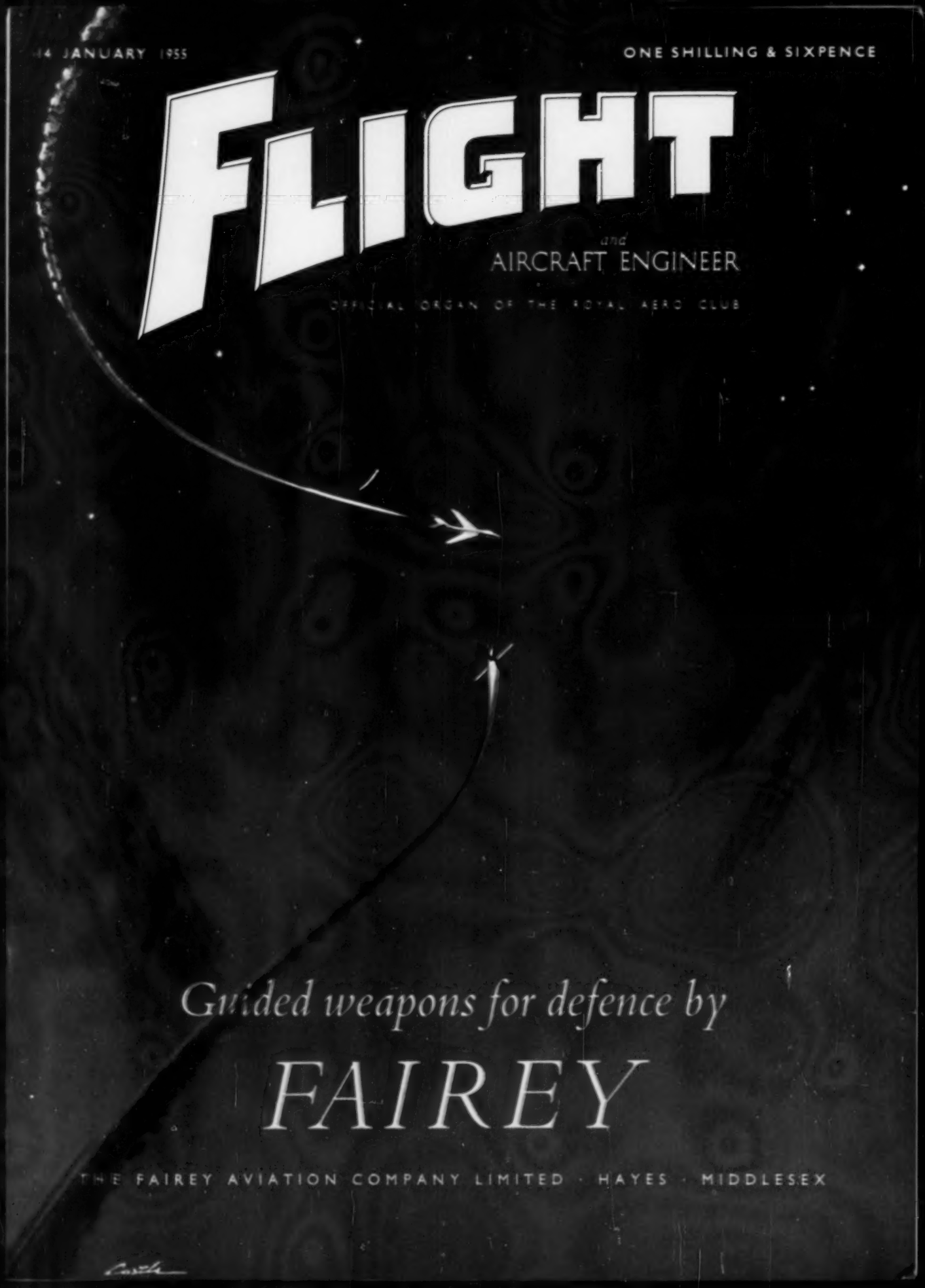

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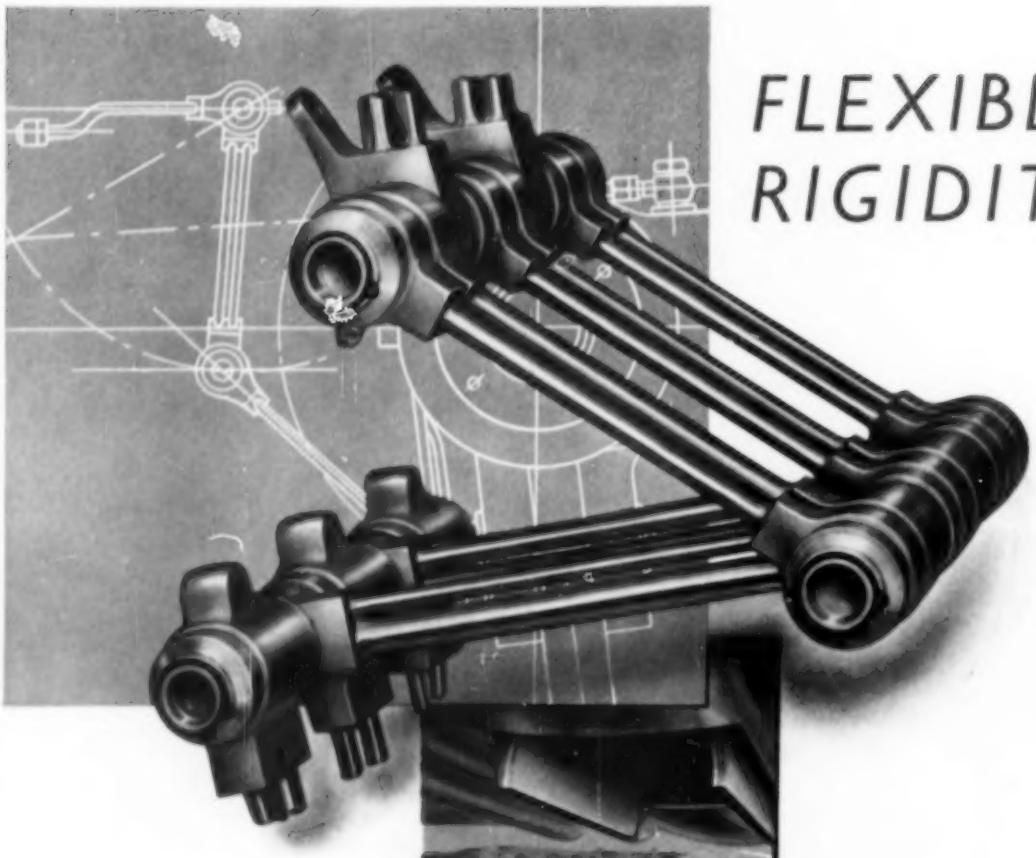

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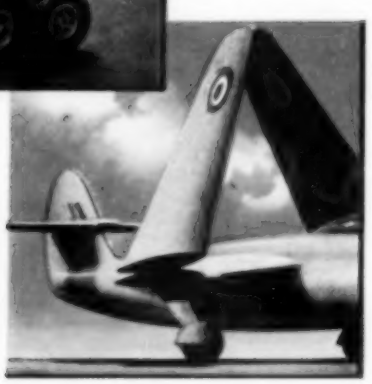

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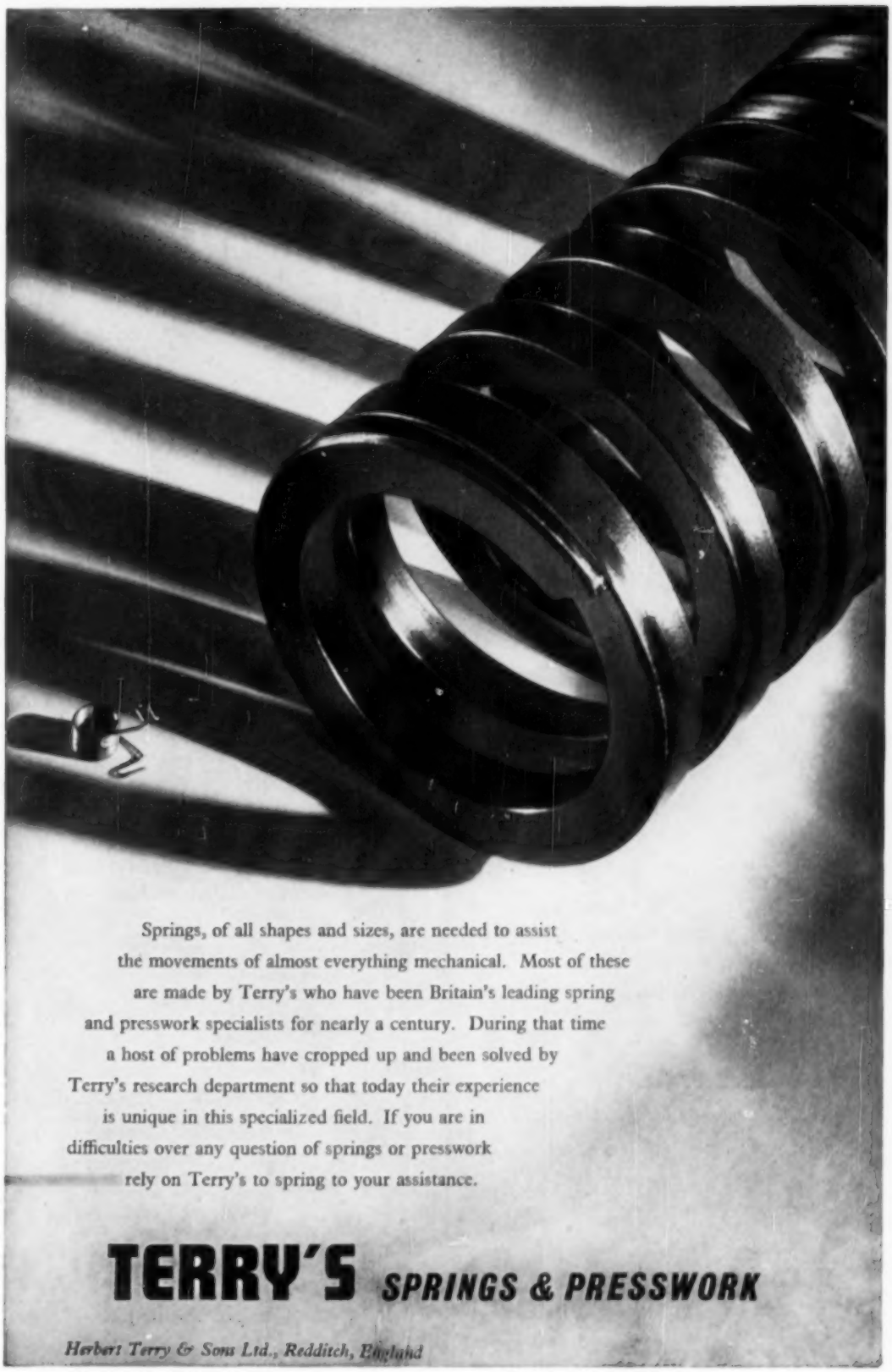
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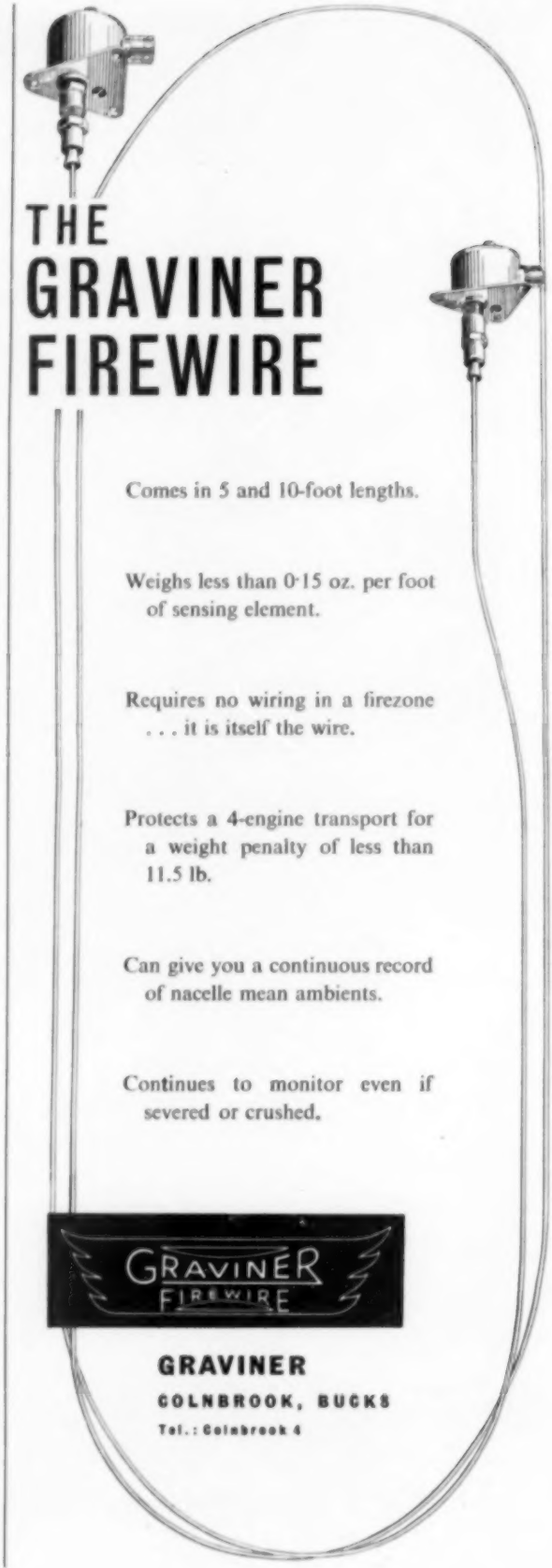

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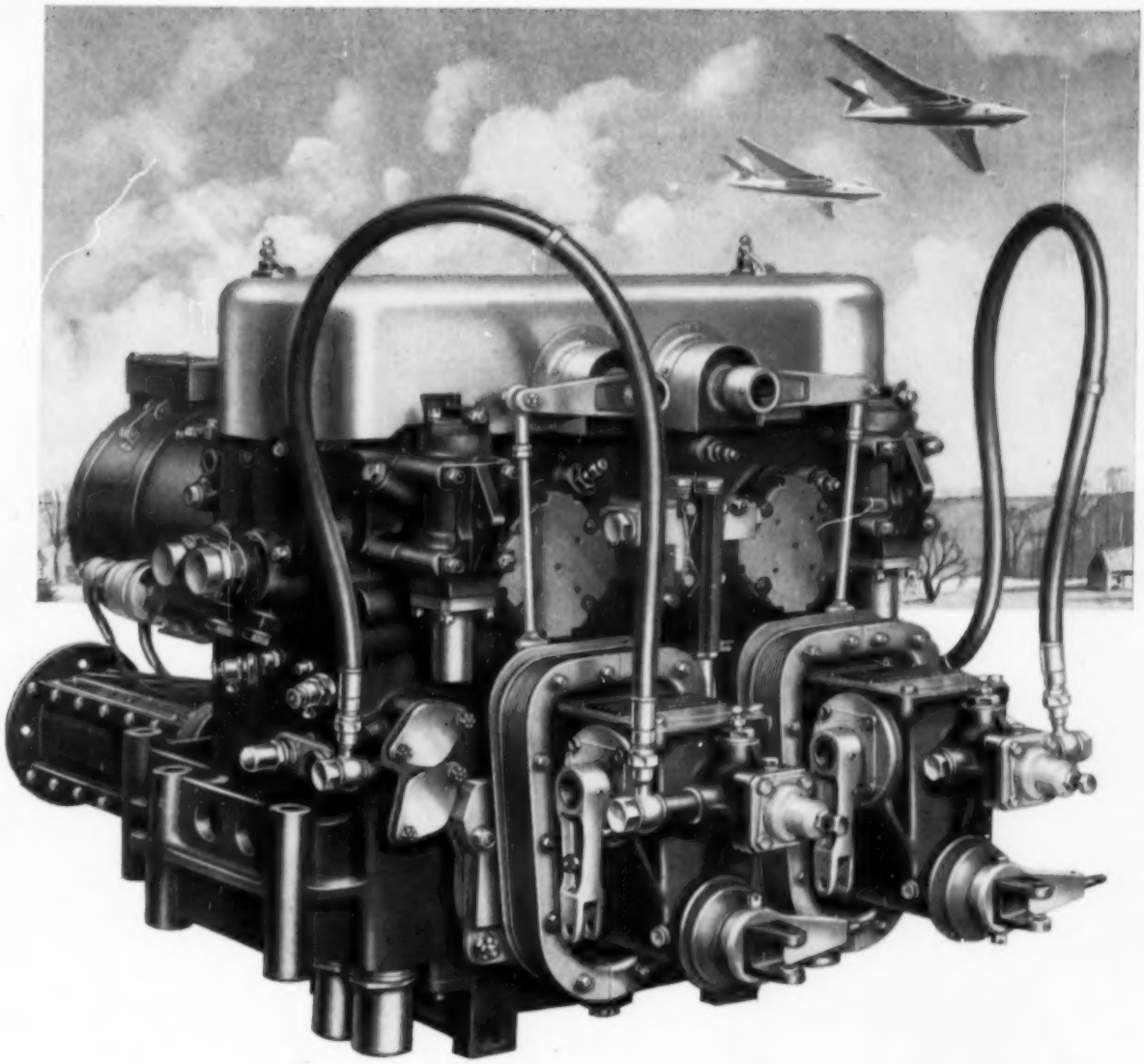

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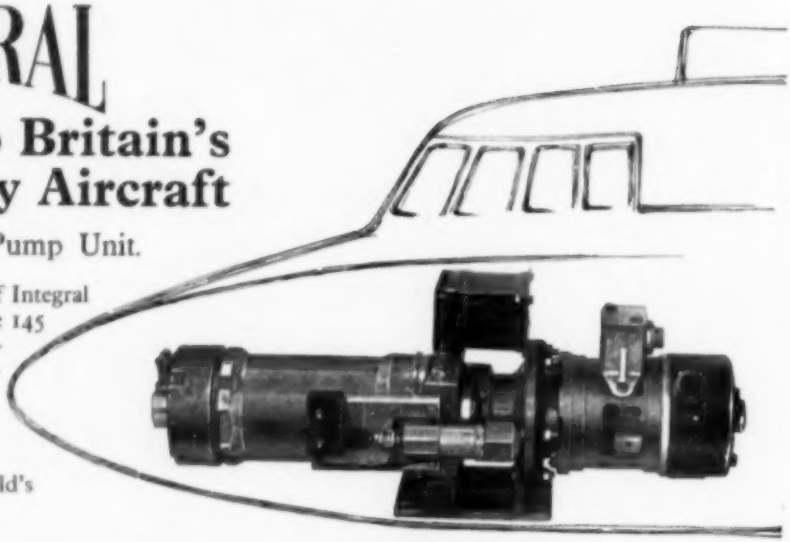

A light and compact self-contained unit, comprising electric motor, two-stage gear pump, hydraulic accumulator and automatic control devices, the Type 145 is available in two versions:

MARK 1 Continuous running blast-cooled motor. Pump on and off-loaded by solenoid valve at pre-determined pressures.

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Both Marks have excess pressure relief valve, and may be arranged for operation at pressures up to 1500 lbs./sq. in.

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A Stiff Nut is a one piece nut which complies with R.A.E. Specification No. A.D. 114 — a nut provided with means of increasing the friction between the thread of the nut and that of a standard bolt to an extent that the nut may be considered self-retaining. A Stiff Nut should be as light as is consistent with strength and be able to withstand all conditions of service use. It should be of a design which does not cause undue damage or excessive wear to the thread of the bolt on which it is mounted.

A perfect description, in fact, of the G.K.N. 'Aerotight' Nut — often casually referred to as a Lock Nut or Self-Locking Nut—which has the added advantages that it can be used over and over again without loss of efficiency. Its retentive properties are unaffected by oil, water or humidity.

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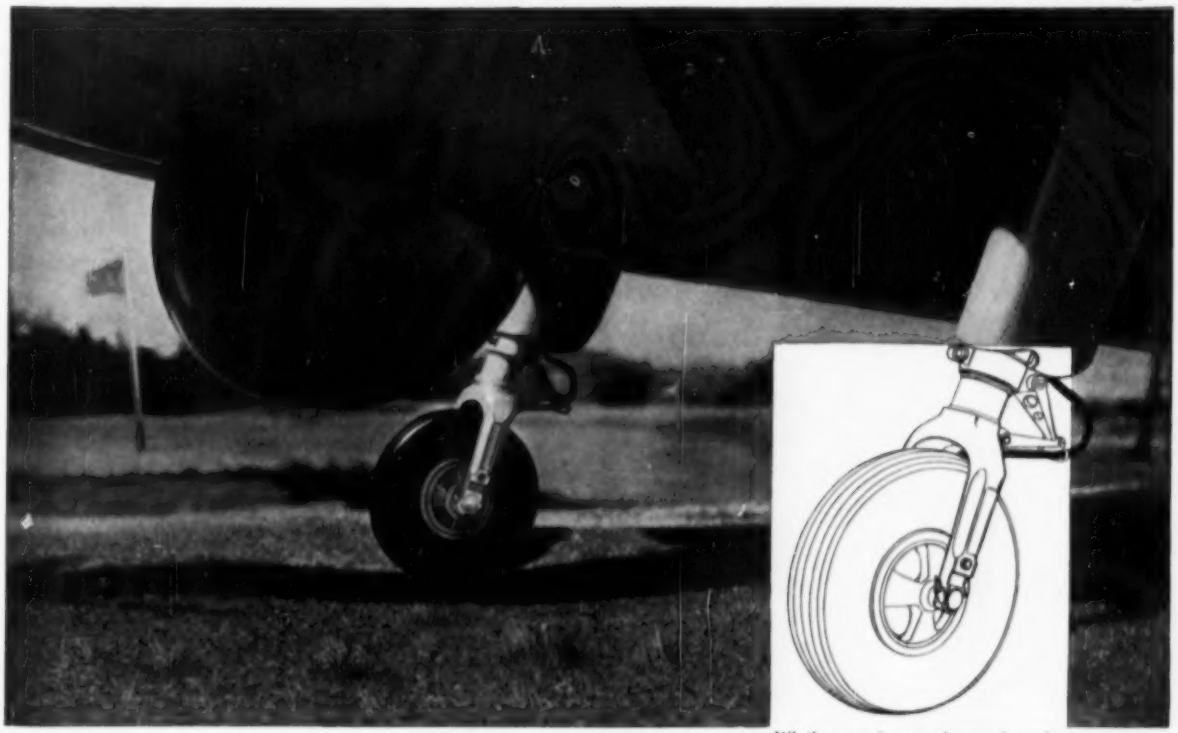
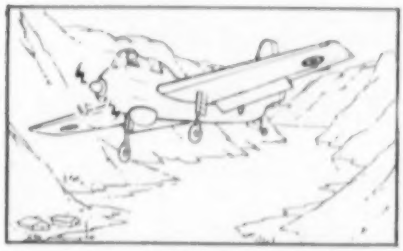
S/A/2002

Golf course fairway — *Seamew* runway



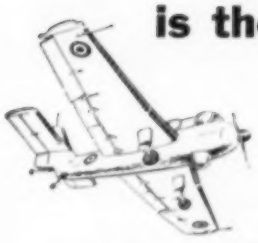
Whether on soft or rough ground, sand or grass, the Seamew can alight in an extremely small area because of its low landing speed and long oleo leg travel. Tyre sizes can be easily changed to suit terrain.

Seamew — a tough, economical, all-weather submarine hunter. In adverse weather — submarine weather — the Seamew can be airborne after a short take-off from an emergency strip . . . can conduct a radar search and low-level attack . . . and can land back safely almost anywhere (even on a golf course!) — due to its slow approach speed and shock-resisting under-carriage.

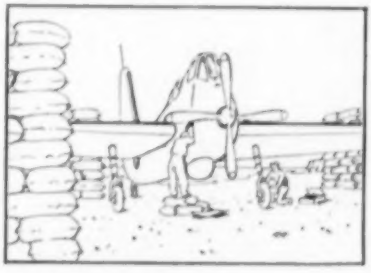


The extremely good handling characteristics of the Seamew combined with simplicity of construction and clear vision make it an excellent aircraft to fly, even for pilots with little experience of this type.

The *Short* answer is the *Seamew*



Economy of manufacture is paralleled by economy of maintenance, in terms of man-hours and spare components.



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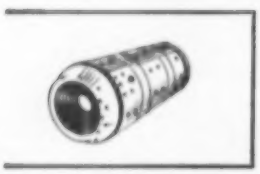

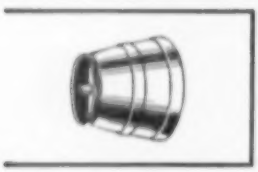

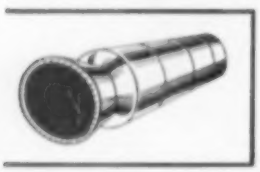

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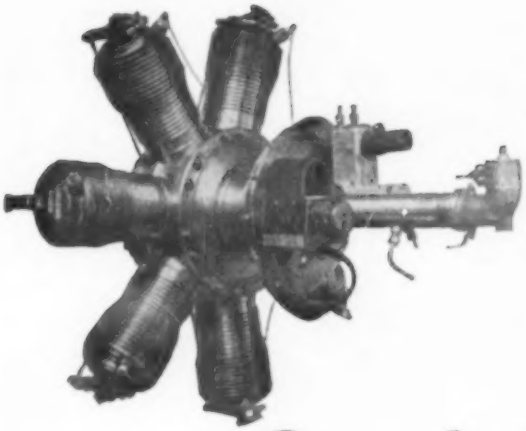
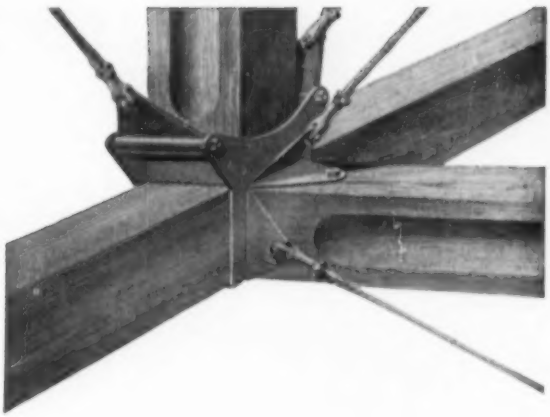
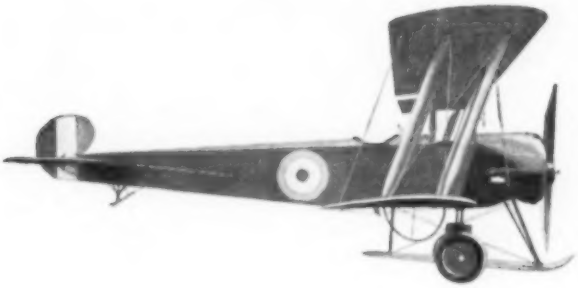
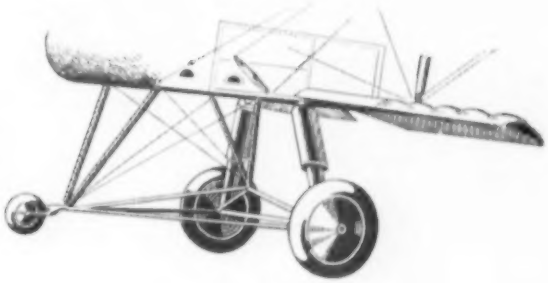




Gone, but not forgotten





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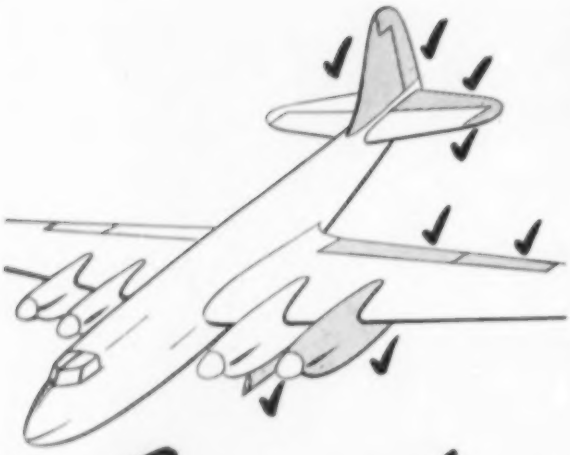

A sound ticking off!

In the Aircraft Industry especially, the correct answer to a production problem is not always sufficient. Experience, equipment and scope are the vital resources. Rubery Owen possess these essential factors and can be relied upon to supply practically any stressed skin component involving sheet metal work, presswork, heat treatment and machining from their own jigs and tools. Fully A.I.D. and A.R.B. approved.

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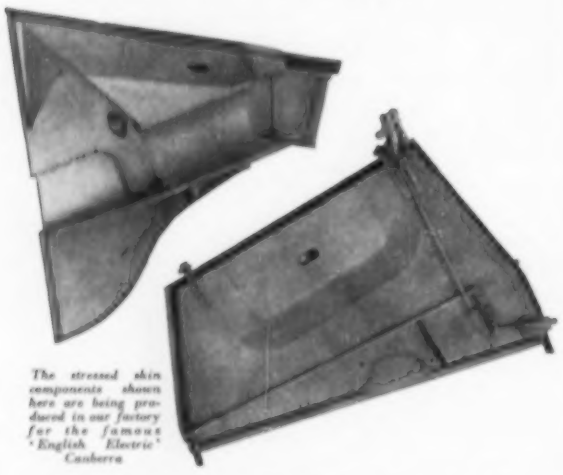

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1 **Main Road.**
2 **Existing airport buildings.**
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5 **Aircraft taking off, seen on three successive rotations of the Scanner.**
6 **Radar site on top of control tower.**

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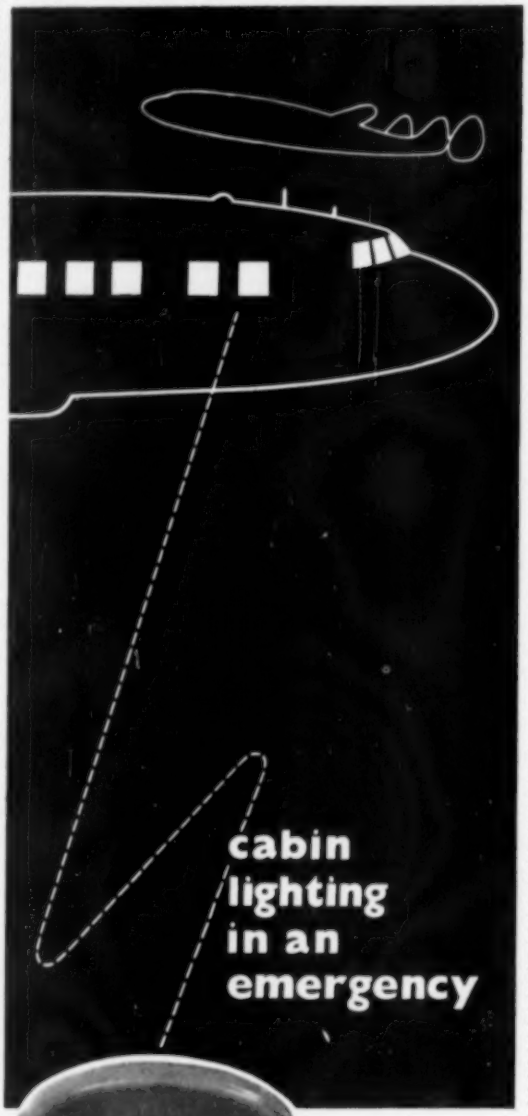

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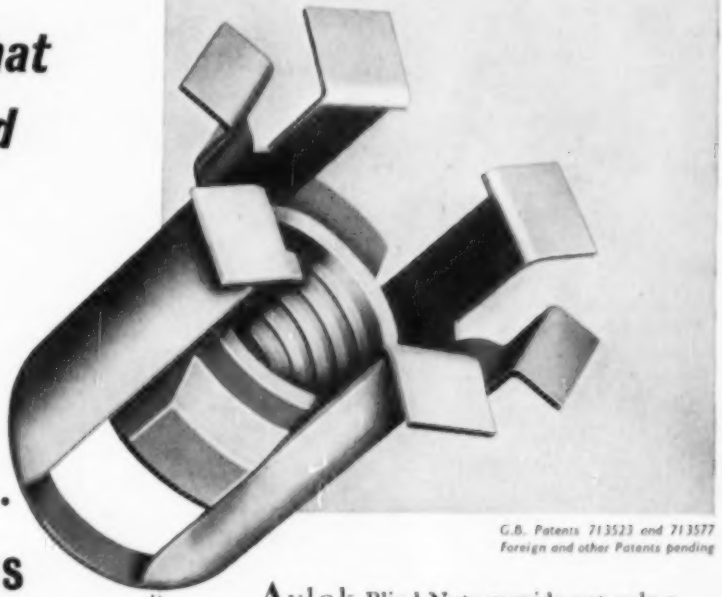
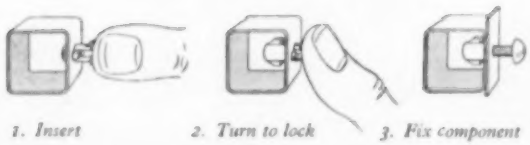


G.B. Patents 713523 and 713577
Foreign and other Patents pending

AS SIMPLE AS THIS



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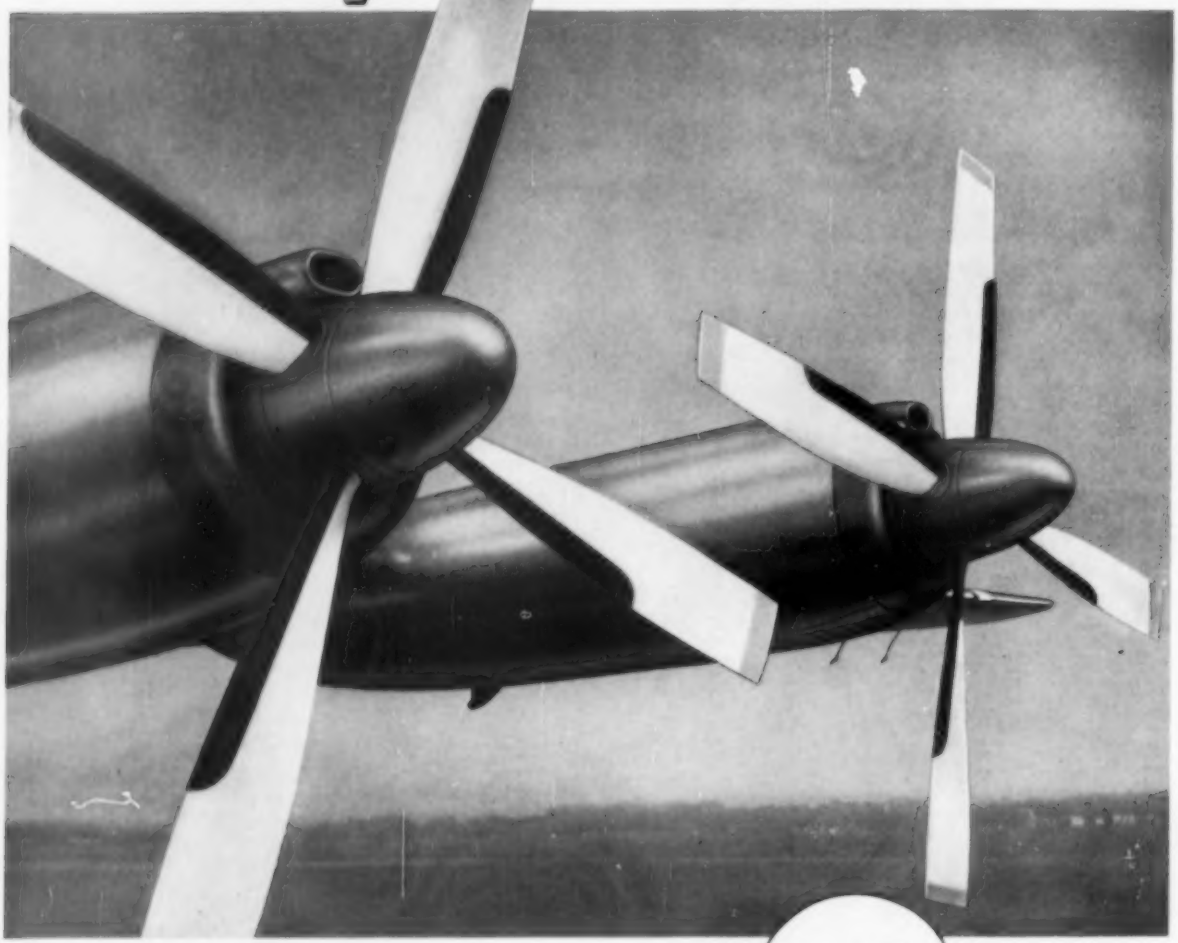

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Growing Pains

LATELY there have been one or two sombre pronouncements on the financial well-being of the air transport industry. We have heard references to its "one per cent profit margin" and "knife-edge economics" and to its "extreme vulnerability to trade recessions and increases in operating costs."

At the same time, 1954 traffic statistics show that the industry continued its post-war expansion. Except in 1951, which was a boom year for the airlines, the annual rate of increase has not been spectacular—a solid 15 per cent or so. Cumulatively, however, this steady year-by-year growth has had two important results: the birth of a major industry in terms of manpower, investment and turnover, and the evolution of a powerful new force in world affairs. This social aspect of air transport is easily underrated, for there is no way of measuring the extent to which its benefits have offset subsidies.

Can this vast development be reconciled with current suggestions that the airline business is in, or on the verge of, dire financial straits? This is a question which might be asked, and not without justification, by some of the older-established, less dynamic industries—particularly those whose loss has been the airlines' gain.

Not many years ago the airline industry was a promising but sickly infant which, financially speaking, needed pampering to keep it alive. Today the need for subsidy has been greatly reduced; in place of the infant we find a still more promising and healthier-looking youth—but one liable to outgrow his strength.

The airline business, more than any other, is based on optimistic planning—on the assumption that more passengers will be carried next year, and still more the year after. This expansion is not achieved without effort, though it is all too easily taken for granted. Airlines can be sure of attracting more passengers only by offering more frequent, more comfortable, faster and—above all—cheaper services. In the absence of new aircraft offering unprecedented economy of operation—and such aircraft are still found more often on paper than on airport aprons—the airlines have been constantly seeking ways of equating lower fares with unchanged or increasing operating costs. The main outcome of their quest has been the gradual spread of "coach" or "tourist" services from America *via* the North Atlantic routes to Europe and thence to the remaining networks. This process is now being blamed for the delicate financial state of sections of the industry. Many airlines disclaim responsibility for their reduced rate of earning, explaining that they would like to charge higher fares but are prevented from doing so by I.A.T.A.

These excuses are true only to a point. In the first place, it must be remembered that the airlines themselves are I.A.T.A. This association is the parliament of the 71 operators who carry seven-eighths of the world's passenger traffic. I.A.T.A. fares are determined by unanimous agreement between representatives of these airlines and thus represent compromise between the highest and lowest rates proposed for any given route.

If I.A.T.A. were to disband tomorrow its rate-fixing functions would be taken over at government level. The reason for ticket-price control on international routes is not hard to find. Every State supports its flag carriers through mail pay or subsidy; even the overseas services of P.A.A. and T.W.A. are not independent in this respect. Uncontrolled competition could thus develop only at public expense. The present system of self-control by the airlines, through the machinery of I.A.T.A., is by no means perfect. It slows the progress of the most efficient carriers, and it restricts the efforts of independent operators who, though not members of I.A.T.A., are forced by governments to abide by its rulings. Nevertheless, no one has yet advanced ideas for a workable alternative. The long-term solution lies with the manufacturers now endeavouring to provide airlines with the equipment which will make them truly self-supporting.

Meanwhile, the airlines cannot have it both ways. If they reduce the price of their product in order to reach a larger market they must expect a lower rate of return. And if they are not prepared to reduce fares they must face a slowing-up in the rate of expansion which they have enjoyed since the start of post-war civil aviation.

Air transport, because of its present and potential value to the community, occupies a place of privilege among the young industries of the world. It is in the interests of airlines and public alike that the family favourite should not become the spoilt child.

FROM ALL QUARTERS

INTERCEPTER: Streaking out over the south coast, this Hawker Hunter F.1 typifies a class of aircraft first introduced into the Royal Air Force by the Hawker Fury biplane—similarly Rolls-Royce-powered.

BRITANNIA AND THE SEVEN SEAS

ON Monday last the Ministry of Transport confirmed that the Minister had received from B.O.A.C. a letter concerning approval to buy nineteen Douglas DC-7Cs. B.O.A.C. could neither confirm nor deny such a request, which had been headlined in a Sunday newspaper.

It will be remembered that only last October a great controversy raged over the suggestion that B.O.A.C. might order DC-7Ds powered by Rolls-Royce R.B.109 turboprops. The DC-7C now being considered has, on the other hand, American Wright piston engines, and the purchase of a fleet of 19 would entail the expenditure of over £15m worth of dollars.

B.O.A.C.'s anticipation of more criticisms was expressed in a New Year message to the Corporation's staff from Sir Miles Thomas, when he said:—

". . . We should never be deflected . . . by ill-informed and at times ill-natured criticism of our policy and aims. In the public controversy aroused by our aircraft equipment problem, particularly that concerning the next four to five years, too many people fail to appreciate that the primary and statutory duty of B.O.A.C. is to operate a world-wide airline, and that if we do not take steps to have the right aeroplanes at the right time, Britain will cease to rank among the major inter-continental air transport undertakings. . . . As we are in a fluid and rapidly developing industry, our motive must always be to offer the kind of aircraft most suitable for the routes on which they fly and to give the best possible service to our customers in whatever country they may be. If we do not, then our traffic will unquestionably go to our competitors—let no one have any illusions about that hard, inescapable fact."

Earlier, when admitting that the Corporation was "informally discussing the potentialities" of the DC-7D, B.O.A.C. had pointed out that "the idea of helping to encourage the use of British engines in aircraft which would probably be sold to airlines throughout the world is naturally of interest." This reasoning could not, of course, apply to the proposal to buy DC-7Cs.

The decision as to whether an order for DC-7Cs is necessary to maintain B.O.A.C.'s competitive position resolves itself largely into a comparative analysis of the DC-7C and the Britannia in terms of performance and availability for first-line service.

The DC-7C, to be known as the Seven Seas, is a long-range version of the DC-7 now used on American domestic routes by several airlines. It differs in several respects, notably in dimensions (10ft more span, 3ft more fuselage and a 2ft higher tail), increased tankage (7,860 compared with 6,400 U.S. gallons), slightly greater climb power and higher all-up weight (139,000 instead of 122,000 lb).

So far 25 Seven Seas have been ordered: 15 by P.A.A., eight by S.A.S., and two by Swissair. The maiden flight is expected to take place towards the end of this year, and deliveries to P.A.A., the first customer, are to begin by June 1956. Deliveries to B.O.A.C. could begin late in 1956.

The main attraction of the Seven Seas will be its ability to operate transatlantic services non-stop in both directions with high regularity, and carrying an economic payload. Douglas quote a range of 5,000 miles with 62 first-class passengers plus baggage, cargo, mail and reserve fuel. Aircraft with such a performance would be able to claim most of the first-class transatlantic traffic; existing equipment would then be relegated to tourist services making at least one stop. By the end of 1955 B.O.A.C.'s North Atlantic services will be operated exclusively with Stratocruisers, which are not capable of direct westbound crossings but can occasionally fly eastbound non-stop with the aid of strong tailwinds. The Corporation's ability to meet competition from DC-7Cs and long-range Super Constellations therefore depends solely on the Britannias which it now has on order.

Of the 25 Britannias being built for B.O.A.C., the first 15 will be of the Mk 100 type (Proteus 705), which is not regarded as a transatlantic airliner. The others will be Mk 300s (Proteus 755), some of which will be the "L.R." type with extra fuel tankage. It is Bristol's claim (though B.O.A.C. have not endorsed it) that the Britannia 300 L.R. will be superior to the DC-7C on all counts. In terms of payload and speed, the Britannia 300 L.R. is estimated to have a 20 per cent advantage over its competitor in both directions between London and New York. The Britannia 300 should be in service with B.O.A.C. by June 1956, and January 1957 is quoted as the introductory date for the longer-range version. By this time the Mk 100 should have seen nearly 12 months' service.

The size of the DC-7C order proposed by B.O.A.C. comes as a surprise. Obviously everyone here would rather see B.O.A.C. purchase only British aircraft, but we would certainly not subscribe to the principle that restrictions should be placed on normal international trading relationships, even in the case of a national Corporation. American interests seem to have taken a broad and generous view of Capital's large Viscount purchase. This country should do likewise in the event of another British purchase of American airliners if this is shown unquestionably to be in the best interests of B.O.A.C. But it does not require nineteen DC-7Cs to guarantee competitive North Atlantic services in 1957, and regardless of the merits of these aircraft now, they are unlikely, with four large piston-engines, to remain competitive for passenger travel for more than two or three years. If the development, production and early service of the turboprop Britannias proceeds smoothly they should be capable of stealing the bulk of first-class traffic by 1958, and of carrying it more economically than any piston-engine type. There is the slight possibility that DC-7Cs might be successfully re-engined during their careers to bring them nearer to Britannia and DC-7D standards and those of the jet airliners of the late 1950s.

Neither the Seven Seas nor the Britannia 300 L.R. is yet flying, so comparisons can be made only between their "paper performances." On this basis, the Britannia promises to be more than a match for its rival, and so far as delivery dates are concerned there is little to choose between the two. By ordering both, B.O.A.C. would certainly achieve insurance against failure of the large turboprop airliner, or further delays in its evolution. It will be for the Government to decide whether the risk justifies so costly a premium.

DC-8 Order Forecast

REPORTS from America suggest that the first airline order for a U.S. jet transport will be placed this year. The operators concerned are United Air Lines, whose president, Mr. W. A. Patterson, states that the initial investment will be some $50m. United's choice is likely to be the projected Douglas DC-8, which would be introduced in 1959-1960. The cost of the aircraft, including its four J-57 turbojets, is expected to be about $4.5m.

In an interview with *Aviation Week*, Mr. Patterson described discussion of long-range turboprop transports as "shadow-boxing," adding "There is no engine available." He said that on stages of over 1,000 miles the jet transport promised to be more economical than the DC-6B. United would continue to operate the DC-6B and DC-7 until the time came to operate pure-jet airliners: "We think that if you buy a turboprop plane today, your competitor can buy a jet and whip you by 200 m.p.h."

The United president implied that he was not interested in buying the Boeing 707. His airline wanted a transport designed initially for commercial rather than military use. He indicated that Douglas proposed to enter a military version of their civil design in the U.S.A.F. tanker-transport competition. Civil production, however, would depend on the company's ability to build

both versions should it receive a U.S.A.F. contract. Mr. Patterson also implied that United did not propose to replace medium-haul Convairs with a turboprop type.

F-102 Modifications

IT has long been appreciated that, irrespective of the thrust available, no aircraft will fly faster than the speed of sound and remain controllable unless its configuration is correct down to the smallest detail. The original Convair XF-102 and YF102, prototypes of a radar-directed, missile-armed all-weather intercepter for the U.S.A.F., looked fast and were very powerful, but it is only recently that, through apparently trivial modifications, the type has exceeded Mach 1.

The principal changes are: a "droop-snoot" along the inner 70 per cent of the span of the five-per-cent-thick wing, in conjunction with two fences; a more conical and drooping nose; a revised canopy with less framework and flatter side-panels; different intake-geometry, capable of passing more air (required by the up-rated J57, which gives 16,000 lb thrust with afterburner); and large fairings to improve flow around the wing/tail/fuselage junction.

The new YF-102A was built in 117 days from the start of redesign. On its second flight it exceeded Mach 1 while climbing to 35,000ft, and Richard Johnson, Convair test pilot, then reported good control as he accelerated well beyond Mach 1 on the level.

Amy Johnson Scholarship

THE first recipient of the Amy Johnson Flying Scholarship, as recorded in our issue of December 31st, is Miss Dorothy White of Runcorn, Cheshire. To mark the occasion of the award a sherry party was given last week by the Women's Engineering Society at 35 Grosvenor Place, London, S.W.1. The president, Miss K. M. Cook, paid a brief tribute to the work of Amy Johnson (who was herself president of the Women's Engineering Society from 1934 to 1937) and went on to explain the foundation of the scholarship. Miss I. J. Ferguson, secretary to the scholarship committee, spoke about the reasons for the award and of the work of women pilots, more than a dozen of whom were present on the occasion. Another award is to be made next year.

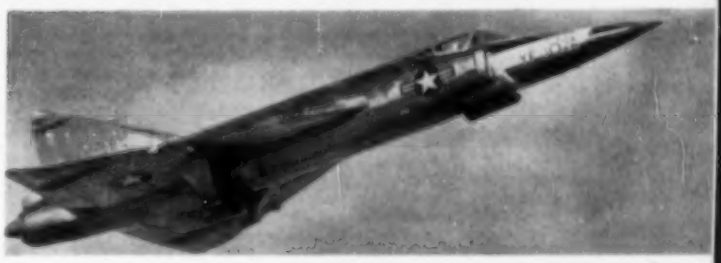
Miss White—who, as mentioned above, is the first recipient—was selected from among 26 applicants. She is 28 years of age and works as a bank cashier. As a member of the Women's Junior Air Corps she won a flying scholarship in 1947; and, for three years until the W.R.A.F.V.R. ceased to exist, she was a pilot in that branch of the Service. With the help of her £150 scholarship she is to try to obtain her assistant flying instructor's certificate—probably at Liverpool.

Living up to its Number

A BOEING B-47 Stratojet of the U.S.A.F. has stayed in the air continuously for 47 hr 35 min, covering during that time some 21,000 miles (i.e., about four-fifths of the earth's circumference). The crew were Col. David A. Burchinal, commander of the 43rd Wing, Maj. Forrest McCoy, Capt. Stephen Franko, and Maj. Pat H. Earhart. Having flown a repeated flight-pattern between North Africa and Great Britain, the B-47 finally landed at Fairford, Gloucestershire. An undisclosed number of air-refuellings took place.

FOUR INTO FORTY-SEVEN: Credit for the magnificent 47-odd-hour duration flight by a Boeing B-47 Stratojet, recorded on this page, is shared by this U.S.A.F. crew. From left to right, they are: Col. David A. Burchinal, Maj. Forrest McCoy, Capt. Stephen Franko, and Maj. Pat H. Earhart. The fourth crew-member was a supernumerary.

The flight recalls the performance of the piston-engined Boeing B-50 bomber *Lucky Lady II*, which, in 1949, covered 23,108 miles in 94 hr. Announcing the B-47's achievement, Mr. Harold Talbott, U.S. Secretary for Air, said that it was made to study range possibilities of the Stratojet and problems of crew fatigue and bombing navigation. It showed, he said, that the U.S.A.F. were second to none in a world in which atomic weapons may decide the outcome of any future war in the first days of conflict. "The Air Force is now getting the planes, radar and other equipment necessary to keep it so strong that no country will dare attack us," he added. But it faces a real problem in keeping qualified men, he said. He called for pay increases and other moves to make the Air Force more attractive as a career.



GOING AND COMING: These photographs show the take-off and landing of the revised Convair YF-102A (see column 1) at Edwards A.F.B. A tail parachute is used for landing.

Canadian Airlift

FINAL phase of the movement of No. 1 Fighter Wing, R.C.A.F., from England to its new base at Marville, France, was to have begun with the departure, on January 10th, of four R.C.A.F. Fairchild C-119F Packets with the first loads of station equipment. The weather on the date of departure, however, was too poor for the airlift to begin. The four Packets, two each from Nos. 436 (Montreal) and 435 (Edmonton) Squadrons, had crossed the Atlantic shortly before and were to carry loads of 15,000 lb direct from North Luffenham to Marville, returning to the U.K. without refuelling. Altogether, between 200 and 300 tons of equipment are involved and the remainder of the 1,000 tons to be moved will be despatched by rail.

Almost all the personnel of the three squadrons are being transported to France and Germany by R.C.A.F. North Stars and the squadrons' F-86s are sent from North Luffenham to Airwork for overhaul and re-assignment to the Greek and Turkish Air Forces. The squadrons are receiving their new Sabre 5s on the Continent as they arrive by "Random" ferry operations from Canada.

The three squadrons (No. 410 and 441 already on the Continent, and No. 439 due to move shortly) will concentrate at Marville as soon as the base is ready and are expected to be operational as a Wing on April 1st. No. 1 Wing will then form part of the 1st Air Division under 4th A.T.A.F., the headquarters being respectively at Metz and Trier.

Avro-Canada Lay-off

IT was announced last week by Avro Aircraft of Toronto that, owing to a "stretch-out" in the production of the CF-100 all-weather fighter, some 1,000 employees have been made redundant; this is approximately one-tenth of the company's total staff (Orenda Engines, Ltd., is now a separate member of the Hawker Siddeley Group).

This news is not unexpected; although the total CF-100 order (650-plus) has not been reduced, production is now going so well that, if the present rate were maintained, there would be a difficult gap before the forthcoming CF-105 could replace it in the factory. The very advanced CF-105 has now been in the active design-stage for about a year, and it may be assumed that it will be ready for production somewhere around 1958.

The Avro "flying saucer" project is now known to have been abandoned, owing to the very heavy expense of developing the idea, coupled with the possibility that the final design would not

APPOINTMENT of Mr. R. C. Handasyde as a special director of Vickers-Armstrongs, Ltd., was recently announced. Son of pioneer pilot and designer G. H. Handasyde, he joined Vickers in 1925, became a flight test observer and eventually, in 1942, production and experimental test pilot. Since 1947 he has been sales manager of the aircraft division.

FROM ALL QUARTERS . . .

represent any great improvement over conventional aircraft.

At present, the rocket-armed, radar-directed CF-100 Mk 4 is replacing the earlier Mk 3 in R.C.A.F. service. As the Mk 3s are withdrawn from the squadrons they are flown to MacDonald Brothers' factory at Winnipeg (this company was recently bought by Bristols), where they are rebuilt as dual-control trainers. Fifty are being converted under a £1.1m contract.

Fraternal Retirement

TWO of the best-known brothers in the industry retired on December 31st—George and Frank Abell of the Bristol Aeroplane Company.

Maj. George Henry Abell, O.B.E., F.R.Ae.S., the elder by one-and-a-half years, was educated at Sherborne and Leeds University and served with distinction in the R.N.A.S. and R.A.F. in World War I. He was a member of the motor industry until 1933, when he joined the Bristol Aeroplane Co. as assistant London manager, becoming London manager about three years later.

For seven years Maj. Abell performed important liaison work between Bristol, other aircraft and engine manufacturers, and the Air Ministry until, in September 1940, he was appointed assistant to the general manager. In 1943 he started the company's armament division and was made its general manager; later this department became the light engineering division and ultimately the car and light engineering division. As the general manager of the division, and a member of the divisional board, George Abell has had the satisfaction of seeing Bristol cars earn a high reputation. His son Charles is B.O.A.C.'s deputy director of operations (engineering).

Maj. Charles Francis Abell, O.B.E., F.R.Ae.S., M.I.M.E.—usually known as Frank—was also educated at Sherborne and Leeds University and likewise gave distinguished service in the R.N.A.S. and the R.A.F. After the war he became a member of the editorial staff of *Automobile Engineer*, but in 1922 left to join his brother in the motor industry. Four years later he renewed his acquaintance with Roy Fedden, whom he had come to know well during the war, and who was then concerned with putting a Jupiter IV into the Gloster Gamecock; as a result of this meeting he joined the Bristol engine department on January 1st, 1927. For some years manager of the experimental department, he was later appointed service manager, and that position he has held up to his retirement.

Appointed to succeed Frank Abell as service manager is G/C. Harold Stringer, O.B.E. Now aged 46, G/C. Stringer joined the Royal Air Force in 1924, as a Halton apprentice. He received his flying training at Abu-Sueir, in Egypt, and on his return to England joined No. 54 (Fighter) Sqn., which was equipped with Bristol Bulldogs.

He was commissioned in 1937 and three years later took the engineering course at Henlow. From 1942 to 1945 he was a M.A.P. production overseer, stationed first with Rootes Securities, and later with the Bristol Aeroplane Co.

After the war he served for a time in Japan as Senior Engineering Staff Officer, British Commonwealth Air Force, and was later posted to Singapore. After returning to England he joined the Air Ministry and was appointed Deputy Director of Technical Training. In 1952 he became Command Engineer Officer at Bomber Command, engaged on Canberra operation and on preparations for the introduction of the V-bombers.

During 1953 G/C. Stringer toured the United States to study the technical organization of the U.S.A.F. jet bomber force. He retired from the Service on November 30th of last year.

Rolls-Royce Chief Test Pilot

FROM Rolls-Royce, Ltd., comes the announcement that A. J. Heyworth, D.F.C., has been appointed chief test pilot in succession to H. N. D. Bailey, B.Sc., who now becomes manager, technical administration. Mr. Heyworth—younger brother of W/C. J. H. Heyworth, who was chief test pilot until he retired from active flying last May—joined the R.A.F. in 1940, on his eighteenth birthday, and in 1941 was posted to No. 12 Squadron, Bomber Command. awarded a Bar to his D.F.C. He 1942 and twelve months later he had completed his second tour of duty and been promoted to squadron leader. During his service with No. 12 Sqn he flew a total of 50 operations and was awarded a Bar to his D.F.C.. He was also Mentioned in Despatches whilst instructing at a training unit. In 1944 he was posted for special duties as a test pilot and in the same year joined Rolls-Royce. He has been with them ever since, becoming assistant chief test pilot in 1954. Altogether, he has flown over 50 different types of aircraft and completed more than 5,500 flying hours. As his assistant in his new post he will have Mr. H. C. Rogers.

Mr. A. J. Heyworth

And Now the SeaMaster

WHOLLY new in concept is the Martin XP6M-1 SeaMaster four-jet flying-boat, designed primarily for minelaying and photographic reconnaissance with the U.S. Navy and illustrated on the opposite page. The turbojets, paired above the wing, are Allison J71s, probably of some 10,000 lb thrust apiece, augmented by afterburning for take-off. Speeds of over 600 m.p.h. are possible, and normal cruising height is quoted as 40,000ft. The hull has been designed for operation "in high waves and marginal sea conditions," and the wing-tips carry non-retractable plastic floats. Within the hull is a watertight rotary mine-door (following the principle introduced by the Martin rotary bomb-door) and embodying a self-sealing rubber pneumatic-tube system.

The crew numbers five: pilot, co-pilot, navigator/minelayer, radio operator and "armament defence operator"—there being a remotely controlled tail turret with two 20 mm guns. Aft of the bow radome is the main deck, with the pilots' compartment; then an entrance compartment with the door on the left side (here the anchor and its gear are stowed); a flight-deck compartment for

BRISTOL BROTHERS Frank (left) and George Abell, whose retirement is recorded above. Succeeding Mr. Frank Abell in the post of service manager to the engine division is G/C. Harold Stringer (right).

As the SeaMaster is withdrawn from its hangar at Baltimore, Martin workers regard with justifiable admiration the striking lines of this latest and fastest large flying-boat. In the lower of the two right-hand views the cut-off stern, with its scanner and barbette blisters, is silhouetted.

crew members; and a pressure-lock for in-flight access to unpressurized areas of the hull. Pressure altitude at 50,000ft would be 21,000ft.

Beneath the flight deck is the electrical and electronics compartment, and to the rear of the pressurized area is the mine-bay, including a portion of the wing centre-section; fuel tanks; air-conditioning and anti-icing equipment; and tracks upon which runs a small trolley for the crew members to pull themselves forward or aft above the mines and other equipment.

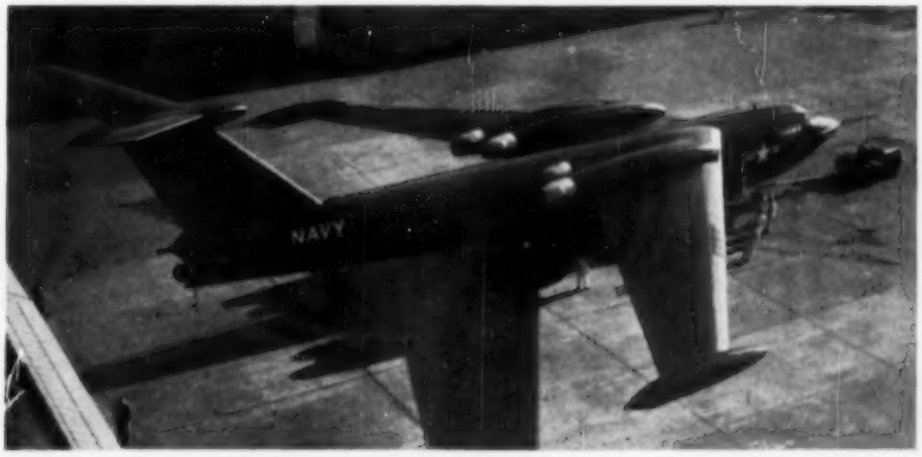
Aft of the mine-bay is the mine-loading compartment, extending the full height of the hull, the mines or other stores being loaded through a large hatch in the top decking. The rearmost compartments house electronic equipment for the tail turret and auxiliary powerplant.

Hull design may be studied in the photographs, and it is known that Martin-designed "hydroflaps," first introduced on the P5M Marlin, are installed on both sides of the afterbody. Opened together, these act as a brake; operated independently they serve as rudders and enable the SeaMaster to make turns of the shortest possible radius.

Hinged panels in the upper portions of the engine nacelles extend the full length and width of the powerplants and permit engine changes afloat. Whereas the pilot has an ejector seat, other crew members would escape through a chute extending from the flight deck down through the hull bottom.

Mr. James H. Smith, Jr., Assistant Secretary of the Navy for Air, apparently had aircraft of the SeaMaster type in mind when he said recently: "The seaplane can soon be given the speed and altitude and load-carrying capabilities of land-based jet bombers. It can be given the ability to operate from any sheltered bay, gulf, lagoon, and estuary having sufficient water depth. It can be given the capability to land in semi-sheltered sea areas, refuel from a waiting submarine, and proceed on its mission. With these capabilities, it could deliver powerful weapons to vital targets, yet operate from a mobile base well removed from threat of heavy attack. The operating base, a seaplane tender, can be given missile and helicopter defences against light air and submarine attack. It can be moved frequently to foil enemy attack. No advance preparation is needed, and no expensive facilities are left behind. With perhaps half a dozen seaplanes, a single tender, and a pair of tanker submarines, we could provide an integrated force that an enemy could not ignore."

The view above shows especially well the dual intakes for the paired Allison J71 turbojets.



(Left) The objects seen on the wings of the SeaMaster are rubber pressure pads, cemented on for simulated load tests prior to flight trials. Note also the afterburners for the J71 turbojets.

DROP TANKS on a helicopter are, at first glance, a surprising sight. With their aid, as reported below, the range of the Piasecki H-21C is likely to be increased to well over 1,000 miles.

HERE AND THERE

D.H.110 Order?

ALTHOUGH, at the time of going to press, no contract had been signed, it has been unofficially reported that the de Havilland Aircraft company will shortly receive an order for the D.H.110 twin-engined all-weather fighter. It is suggested that the type will be bought in substantial numbers, and that it will become the standard all-weather fighter of the Royal Navy. A contract figure of £20m has been mentioned, which would represent something like 100 aircraft.

A Beryl Turbojet Reappears

TRIALS will shortly start on Ullswater with Donald Campbell's *Bluebird*, with which he hopes to capture the world's water-speed record (178 m.p.h.), and which is powered by a Metropolitan-Vickers Beryl turbojet of 4,000 lb static thrust. Although it is 24ft long and has a beam of 3ft 8in, the hull—which has a frame welded from 275ft of Accles and Pollock steel tubing—weighs only a matter of 580 lb. The builders of the hull are Samlesbury Engineering, Ltd.

Helicopter Drop Tanks

THE Piasecki H-21 Work Horse troop and cargo transport, now coming into service with the U.S. Army in large numbers, is believed to be the first helicopter to carry jettisonable external fuel tanks. Both the H-21B and the H-21C (see photograph above) are likely to have the new equipment. Two streamlined tanks, each of 165 gallons capacity, are carried side by side on bomb-type release units under the cabin. They are supported laterally by a tubular framework and quick-release straps. Normal range of the earlier H-21A Work Horse, with de-rated engines, is quoted as 600 miles at a cruising speed of 104 m.p.h., on an internal fuel capacity of 304 gallons; so the range of the H-21C, even allowing for its fully rated 1,425 h.p. Wright R-1820-103 engine, should be well over 1,000 miles with the new drop tanks (which, incidentally, are made by Beech Aircraft and Fletcher Aviation).

ELECTED president of the Institute of the Aeronautical Sciences is Mr. Robert Gross, president and Board chairman of Lockheed Aircraft. Succeeding Mr. J. L. Atwood, of North American Aviation, he takes up his new duties at the Institute's honours night dinner on January 24th.

Denied

A REPORT from Bonn says that no appointment for the command of the Federal German Air Force has yet been made. It was stated a month ago that Gen. Galland, an ex-Luftwaffe fighter pilot, was to be given the post.

Secretarial

THE newly appointed president of the Chartered Institute of Secretaries is Mr. B. G. Porter, D.F.C., administration director of B.O.A.C. He is now beginning a tour of the Institute's branches in Australia and New Zealand.

Helicopter Question-time

THIS evening, January 14th, the Helicopter Association is holding another of its brains trusts. The panel consists of Mr. Basil Arkell, W/C. R. A. C. Brie, Mr. Raoul Hafner, W/C. G. M. Macintosh and Dr. H. Roberts; Mr. Thurstan James is question master.

Air Photography Exhibition

AT the Kodak galleries in Regent Street, London, a display of aerial and survey photographs taken by companies of the Hunting Group was opened on Monday last by Mr. A. D. Dodds-Parker, M.P., Parliamentary Under-Secretary of State for Commonwealth Relations. Pointing out the importance of aerial survey of undeveloped areas, Mr. Dodds-Parker recalled painful memories of trying to find his way on camel-back in the Sudan with the aid of inaccurate maps. He also spoke of using, with A. Cdre. Fielden of the Queen's Flight, and W/C. Grierson, aerial photographs for selecting landing grounds for the Lysanders employed to drop agents in enemy-occupied territory during the war. The exhibition, which will remain open until January 29th, is well worth a visit. Aerofilms have remarkable exhibits in colour and in black and white, and on the aerosurvey and geophysic side there are a number of interesting mosaics overlaid by classification tracings. There are also photographs showing installations of Williamson and Vinten cameras, and of Wild A.5 plotters.

NATO Standardization Post

THE Standing Group of NATO has approved the appointment of A.V-M. E. M. F. Grundy, O.B.E., as chairman of its Military Agency for Standardization. The agency—which has been doing valuable work in standardizing aircraft, armament and other engineering components, particularly between British and American types—has its headquarters in London. A.V-M. Grundy entered the Service as a Cranwell cadet in 1926 and during the war period was engaged mainly on signals duties.

Vancouver C.A.I. Branch

PLANS are in hand for the formation of a Vancouver branch of the Canadian Aeronautical Institute. The work is in the hands of an interim committee, with Mr. R. J. McWilliams and Mr. T. W. Siers, both of Canadian Pacific Airlines, as president and secretary respectively. It is probable that a full committee will be elected in the near future and that the inaugural lecture meeting will be held in March, on the occasion of a visit from Capt. Laurence Pritchard, who is now touring North America.

Film Worth Seeing

THE CinemaScope film *This Supersonic Age*, recording the 1954 S.B.A.C. display, looks like breaking all records for any documentary flying film. The distributors, Twentieth-Century Fox, have already received orders from Britain and abroad for more than 450 copies. Some 330 are going to North America, and 22 other countries will also see the film. The general release in this country is next week, but the film is already showing in 13 "first-run" cities. When we reviewed it in our issue of December 10th, we described it as: "A superb record of a great occasion . . . that will enthral everyone."

HIGH AERODYNAMIC EFFICIENCY

The Eland is an aero-engine giving high power at low cost. It is a single-shaft propeller-turbine developing 3,000 e.h.p. at take-off, with a diameter of only 36 inches. This compactness makes for high aerodynamic efficiency. Other notable features include smooth, surge-free acceleration, low specific weight and low fuel consumption. All in all, the Eland is an impressive example of design and manufacture at the service of commercial aviation.

NAPIER Eland

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THE INTERNAL BRAKE

—Maximum kinetic energy capacity in minimum space

Two versions of the Internal Brake, both of dual disc construction.

BUILT FOR JET SPEEDS

Specifically built by Goodyear to handle high speeds, loads, energy and deceleration requirements, the internal brake fits completely within the wheel. In fact, either one or both bearings are mounted around the brake. Proved in military service and by combat experience, these disc brakes meet the need for maximum kinetic energy capacity disposed within the smallest possible space.

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TURBOPROPOSALS

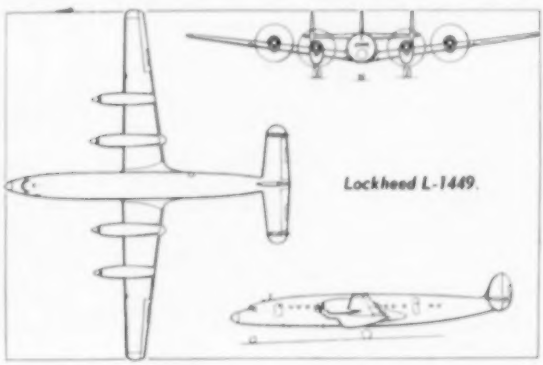
American and French Designs for Two Classes of Traffic

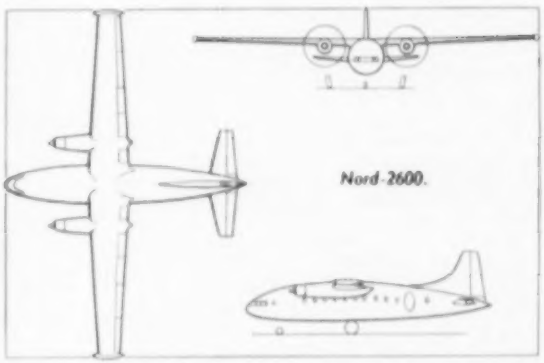
FOR long- and short-range commercial service respectively come contrasting proposals for turboprop aircraft by an American and a French manufacturer. The Lockheed L-1449, preliminary details of which were given in *Flight* of December 17th, is a fast, long-range machine for the world's trunk routes, and the Nord-2600 is a relatively short-range machine of moderate performance.

Lockheed L-1449.—This very extensively redesigned version of the Super Constellation is expected by the makers to have a block speed 70 m.p.h. faster than "any current or forecast piston-engined commercial transport" (Douglas DC-7C) and 30 m.p.h. faster than "any projected propeller-driven long-range commercial transport" (Douglas DC-7D). In the first instance four Pratt and Whitney PT2 turboprops of 6,000 e.s.h.p. would be installed, with Rolls-Royce R.B.109s, Pratt and Whitney T52s, Allison T56s, or Bristol BE.25s as alternatives. Cruising speed should be superior to 420 m.p.h. at 30,000ft.

Apart from the power plants, the most notable feature of the L-1449 is the completely new thin wing, measuring 27ft more in span than that of the present Super Constellation. A simplified four-tank fuel system, with single-point under-wing refuelling, is planned. No tip tanks are foreseen "at the moment."

According to *Aviation Week*, T.W.A. are still deliberating whether to order any of the new Lockheeds, though aware that they would have priority on any production line. More complete information on the pure-jet Boeing 707 is being sought before any decision is taken. Our American contemporary quotes industrial opinion that if the L-1449 is not ordered by T.W.A. (which would need about 35 machines) it would probably not be built at all.





As already indicated, the new Lockheed would be directly competitive with the Douglas DC-7D and, of course, with the Bristol Britannia. Meanwhile the ding-dong "paper" battle continues with the news that on the drawing-boards at Santa Monica is a thin-winged version of the DC-7 designed (with turboprops of unspecified type) to cruise at 425 m.p.h. with 110 passengers. Cruising speed of the DC-7D with the R.B.109 has been put at 385-390 m.p.h.

Nord-2600.—This projected 40-passenger transport has a high wing of 95ft span and a 66ft fuselage of unusual form (seen general-arrangement drawing). Aspect ratio of the wing is 11.2 : 1, and the laminar-flow section is N.A.C.A. 63.

In addition to two Rolls-Royce Dart turboprops, a pair of tip-mounted Turboméca Palas turbojets, each of 350 lb static thrust, are foreseen as normal equipment. They are intended to permit operation "at higher all-up weights."

Specifications of the Nord-2600 are by no means in a final state, but the design study was based on a stage-length of 1,500 km, corresponding, for example, to Paris-Algiers (1,430 km). Quoted cruising speed is 295 m.p.h. at 19,700ft and design gross weight about 37,500 lb.

The French civil aviation budget, recently approved by the National Assembly, allots £1.7 million for the construction of a prototype either of the Nord-2600 or the Hurel-Dubois H.D.70 (also designed for Darts).

THE TV FILM: WAR OVER ITALY

ENTITLED *Wings Over Italy*, Episode 9 of the B.B.C. Television film *War in the Air*, afforded viewers another chance of a direct comparison with the American film *Victory at Sea*, as it encompassed the invasion of Sicily and Italy, covered in *Roman Renaissance*, Episode 14 of the earlier film.

Reluctantly, one must record that the American film was the better of the two. The scale of the spectacular paratroop drops carried out during the invasion of Sicily was not conveyed at all well and no mention was made of the tragic consequence of faulty aircraft recognition by naval gunners, due in part to bad liaison between the air and naval commands and to the inexperience of the pilots of the glider tugs. A non-aeronautical error was the figure of 2,000 given for the number of ships in the invading convoy; there were, in fact, 3,000—the war's biggest convoy.

No mention was made of the earlier capture of the island of Pantellaria—small, but historically interesting as the first territory to be conquered and subdued entirely by air power.

Seafires were shown taking off from carriers to support the landing of the American 5th Army at Salerno, but no mention was made of the heavy losses, due to pilot fatigue, suffered on their return. It had been planned that the Seafires would provide air support for two days, but the failure to capture an airfield meant that they were engaged for four days, with disastrous results as the tired pilots attempted to re-land on the carriers.

Only brief reference was made to the German use of "radio-controlled glider bombs" after the landing at Salerno. As the Henschel Hs293 glider bomb had been in operational use since the summer of 1942, this presumably referred to the radio-controlled "Fritz X" armour-piercing bomb. One of these bombs sank the Italian battleship *Roma* after her surrender to the Allies. A specific comment on this weapon would have been welcome.

The tragic bombing of Monte Cassino was shown. Elements from four Air Forces dropped 1,100 tons of bombs on this ancient monastery and nearby village. It is now thought that at the time no German troops were actually in the monastery, and the ruins afterwards proved easier for them to defend. One could not, however, fail to give due credit to the German troops who stuck to their dugouts and were ready for the Allied troops when they advanced after the awe-inspiring bombardment.

The capture of Naples and the important network of nearby airfields enabled Allied strategic bombers to be based on the European mainland. Shots were shown of B-24 Liberators and B-17 Fortresses, escorted by Lightnings and Mustangs, on missions to the Balkans, Austria and Germany. These daylight attacks were followed up by an excellent sequence depicting night raids on Northern Italy and the Adriatic by R.A.F. Wellingtons. A town was shown blazing, and this would have been an appropriate point to bring out the comparative destructiveness of incendiary and H.E. bombs. Experience had shown that whereas one ton of high explosives laid waste about 1¼ acres of built-up area, one ton of incendiaries destroyed about 3¼ acres.

In spite of itself, however, the film could not help but give some impression of the value of air superiority. Many shots of the straffing of trains and other ground targets were shown. Several exciting air-to-air combat scenes were also included, mostly of Fw190s and Me109s being shot down. Of the Fw190s shown the wings of no fewer than three were seen to break off just outboard of the airscrew disc. It was noticeable, too, that the Me109s attacked in formation—a change of tactics by comparison with earlier air battles over Germany.

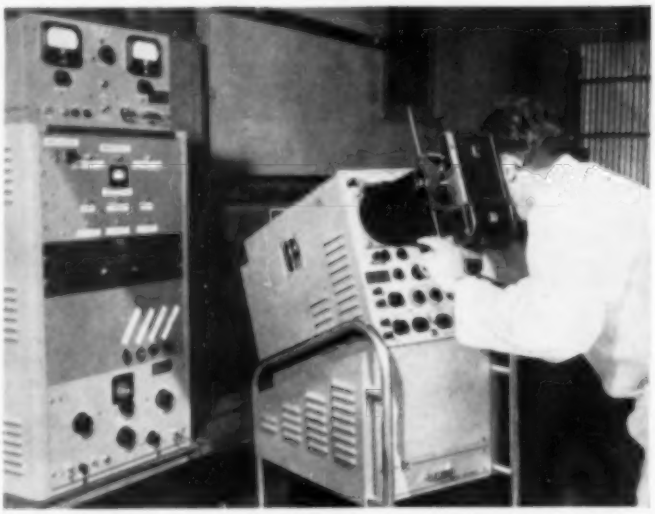
M. F. A.

Rocket Combustion Instability Investigated

ONE of the major problems in the design of large-scale, long-range rockets, the phenomenon known as combustion instability has recently been the subject of experiments at the Stanford Research Institute in the United States. Occurring for no apparent reason, and causing vibrations which can throw a rocket off-course and may be violent enough to destroy it, the effect is variously referred to as rough burning, chugging, humming, groaning, screeching or motor-boating.

Investigating the problem for the Soundrive Engine Company of Los Angeles, who are pioneers in the rocket field, the Stanford research team (which included an acoustics physicist, a combustion physicist, a mechanical engineer and an electrical engineer) worked on the theory that pressure changes within the rocket motor could be controlled by changing the sound-absorbing characteristics of the motor walls, theoretical and experimental studies having shown that energy in acoustic waves could be absorbed by porous materials lining a cylinder.

Elaborate instrumentation was devised for studying the time required for ordinary burning of gases within a steel tube to build up to detonation point; and experiments were made with various liners in order to find whether their acoustic qualities would inhibit the formation of detonation waves and so eliminate the combustion instability caused by local pressure build-ups moving about within the motor.



A physicist uses the oscilloscope during experimental firing of the tube. On the left is the firing control panel.

A steel tube was fitted at intervals with ionization gauges made from ordinary sparking plugs. Using a hydrogen-oxygen mixture of gases and an electric spark for ignition, the flame-front was observed and the detonation induction distance measured. The length of the pre-detonation burning is governed by considerations of fluid mechanics and kinetics, while the formation of the detonation wave depends on the time required to build up a pressure wave of sufficient strength to create detonation; the velocity of such a typical detonation wave is approximately 8,000ft/sec.

As the flame-front passed down the experimental tube small electric impulses were generated on each gauge. These were amplified and shown on an oscilloscope. Since the detonation time proved faster than could be indicated on an available oscilloscope a system of multiple sweeps on a single oscilloscope was utilized.

Ten ionization gauges were used and were placed between zero and 40in from the spark. At the critical part of the tube—in the region in which detonation would occur—the gauges were set at 2.5in intervals to give greater accuracy, whereas wider spacing was allowed in the rest of the tube. By measuring the distance between the blips generated by the ionization gauges the detonation point was determined. The detonation induction distance was found by computing the velocity of the reaction zone between successive gauge stations, assuming the transition from combustion within the 2.5in interval preceding that interval for which detonation velocity was observed.

Linings with different acoustic characteristics were used in the tube, the most pronounced effect being noted in the experiment with a one-inch coarse bronze liner, which had a median value for the detonation induction distance of 22.5 to 25in. A 0.5in coarse bronze liner showed the next most marked effect, with the distance equal to 20 to 22.5in. A one-inch fine sintered bronze liner gave an induction median of 17.5 to 20in and a 0.5in fine liner a median equalling 15 to 17.5in. All these results compared with a 5 to 12.5in spread for induction distance in unlined tubes and showed a marked change in detonation characteristics when bronze liners were used.

The knowledge gained from these studies is regarded as an important step forward in the understanding of the formation of detonation waves and in the correction, in the design stage, of factors leading to rocket combustion instability without costly trial-and-error methods.

J.G.

Adjustments being made to the connections of the ionization gauges before one of the tests. The gauges are adapted from ordinary sparking plugs and screwed into the tube.

BIG JET—BIG THRUST

FIRST run in May 1952, the S.N.E.C.M.A. Vulcain is one of the largest turbojets in the world. Its development has so far been comparatively uneventful, and steady increases in thrust have been reported culminating in the news that, a few weeks ago, a five-minute run took place at a rating of 6,000 kg (13,228 lb). This thrust was recorded dry, without any form of power boosting. The Vulcain is a single-shaft engine, rather similar to the familiar Atar; it is scheduled to power several advanced French types.

BRAZIL'S AERONAUTICAL COLLEGE

SINCE its foundation in 1949, the Aeronautical College of the Brazilian Air Force at Guaratingeta, São Paulo, has trained 15,000 specialists, and about 1,900 more have been enrolled for this year's courses. These courses, 20 in number, include wireless telegraphy, photography, all types of repair, maintenance and installation work, flying control, and meteorology. Preparations are now being made to give training in gas-turbine maintenance. There are 40 officers and 160 sergeants on the staff.

Courses last between 17 and 23 months and pupils are paid about £11 per month during special training. They pass out as "3rd specialized sergeants" and can subsequently gain commissions. They may also leave the Air Force in order to take appropriate employment with the airlines.

HIGH-LIFT GENERATION

PART 2

By A. R. WEYL, A.F.R.Ae.S.

AS stated in the concluding paragraph of Part I of this article, to develop aeroplanes which are able to compete with the helicopter, three requirements will have to be satisfied: (1) High specific lift; (2) abolition of the stall, or, at least, incidence of incipient stall remote from operational maximum lifts; and (3) lift generation at zero forward speed. It can be shown that these three requirements are not beyond our reach. Aeroplanes with such features will, of course, be rather different from the customary high-speed type; and, in many ways, basic research is involved.

High-lift Realities.—Substantially increased specific-lift forces are quite possible so long as we do not insist upon low drag. Some comparative figures, though without claim to accuracy, will be indicative.

A modern high-speed and low-drag ("laminar") aerofoil section has a maximum lift coefficient of the order of 1.2, at about 13 deg critical incidence. Good plain cambered sections reach 1.6, at 16 deg. Highly cambered aerofoils (like those of turbine blades) give 10 to 20 per cent more.

A leading-edge slat, with a slot to energize the boundary-layer flow and to intensify the low-pressure region over the slat, may add 80 per cent to the basic lift maximum. Split flaps and trailing-edge flaps increase the effective camber and/or induce vigorous boundary-layer flow near the trailing edge; they may increase the basic-lift maximum by half or decrease the zero-lift incidence, but, unlike the slat, they do not increase the incidence of stall. More effective are extending-chord flaps, if (as is usual) the lift is referred to the original wing area; thus values of nearly 3.0 for the $C_{L_{max}}$ have been reached, at incidences of 13 deg. Slats and slotted trailing-edge flaps, used in combination roughly double the basic lift. Flaps of all sorts are in practical use but slotted wings have become rare indeed, except for specific slow-flying aircraft. In a wind-tunnel test, a completely slotted aerofoil of eight slats and seven slots has produced a $C_{L_{max}}$ of 3.92 at 45 deg incidence.

Wind-tunnel tests with mechanically more complicated double-flaps of the extending-chord type, combined with leading-edge slats, have given $C_{L_{max}}$ values of the order of 4.4, at 28 deg incidence; no aircraft has as yet operated with such an arrangement and at such high lift.

All these high-lift gadgets do nothing more than postpone flow-separation to higher effective incidences, i.e., they extend the useful lift range and, in some cases, make the lift-curve approximate more closely to that predicted from theory.

Power-assisted high-lift devices (Fig. 11) generally expend mechanical energy upon manipulation of the boundary layer, by means of suction or blowing, or by both in combination. About a dozen research aircraft have been flown with equipment of this kind. Usually, the initial reports are enthusiastic, but subsequently nothing more is heard of any intended application. An exception might have been an Arado 232 prototype with a combined suction and discharge arrangement and a wide, extending-chord flap. This should have attained, in actual flight, a maximum lift coefficient of 3.8 at 10.5 deg incidence, and the handling properties were reputed to be tolerable in spite of very high wing-loading. The same high-lift value was achieved in flight with a modified Storch research aeroplane which had a suction flap of the Schrenk type. To the author's belief, these are the highest lift values ever recorded in steady flying.*

In laboratories, higher $C_{L_{max}}$ values have been observed with assisted devices. The operation of distributed suction slits on the dorsal surface of a cambered aerofoil of 30 per cent thickness gave (with substantial end discs) a value of 6.1 at 70 deg incidence.

Very high lift coefficients can be produced with rotating cylinders (Figs. 12 and 13). A. G. von Baumhauer reported measured values of up to 15, and theoretically higher values can be expected. This "rotor" lift is entirely independent of incidence, and thus free from stall. Circular cylinders, however, are not very practical as lifting aerofoils. The circulation depends on peripheral velocity; hence, the rotors are clumsy and very heavy on account of their great diameter; or, if they are kept slender, very high rotational speeds are required. The installation of rotors in aerofoil shapes has proved a dismal disappointment, on account of disregard for boundary-layer effects; with a leading-edge installation, as the optimum arrangement, a $C_{L_{max}}$ of only 2.4 was recorded, and the profile drag was exceptionally high.

An interesting suction wing by B. Regenscheit, of Göttingen (Fig. 14) produced particularly high lift. The trailing edge of a normal N.A.C.A. 23015 section was obliquely cut so as to accommodate a suction slot instead of the trailing edge, and a flap was deflected by 45 deg aft of it (Fig. 15). With this, a $C_{L_{max}}$ of not less than 12.5 was reached, at 21 deg incidence. Unfortunately, the power required to operate this supercirculation at a full-scale wing would amount to about 6,300 b.h.p.

It is interesting to speculate upon what such an enormous expense of mechanical energy is expended. Suction is, of course, less economical to produce than pressure energy (discharge

**The Supermarine 322 "Dumbo" of ten years ago recorded 3.9 in controlled flight. Further Details of the Arado and other systems appeared in our issue of November 12th last.—Ed.*

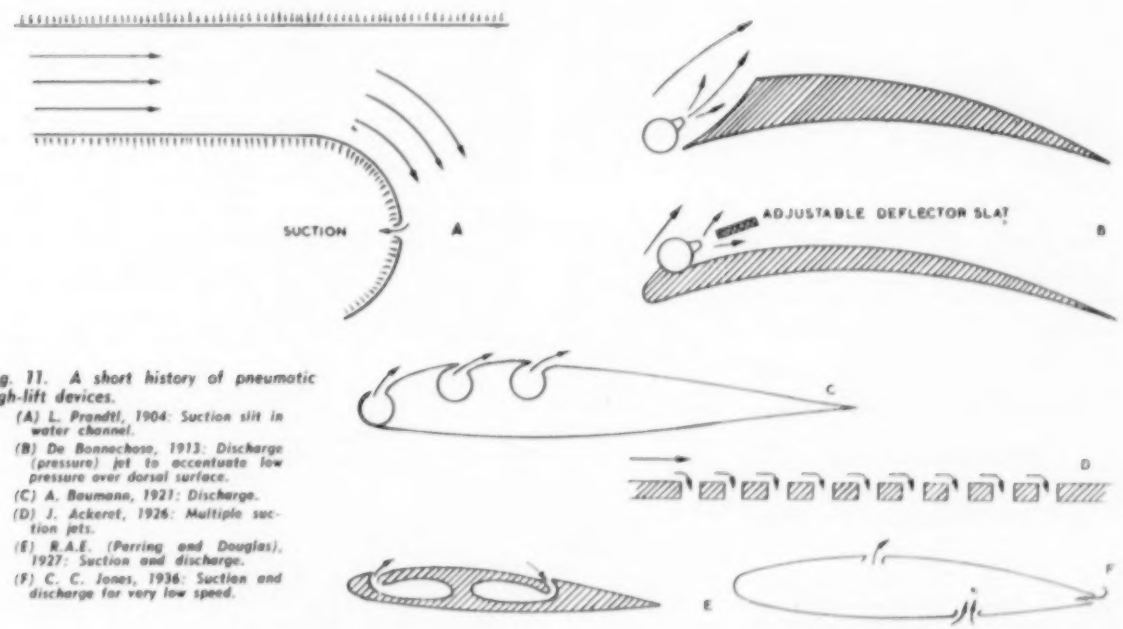


Fig. 11. A short history of pneumatic high-lift devices.

(A) L. Prandtl, 1904: Suction slit in water channel.

(B) De Bonnechose, 1913: Discharge (pressure) jet to accentuate low pressure over dorsal surface.

(C) A. Baumann, 1921: Discharge.

(D) J. Ackeret, 1926: Multiple suction jets.

(E) R.A.E. (Perring and Douglas), 1927: Suction and discharge.

(F) C. C. Jones, 1936: Suction and discharge for very low speed.

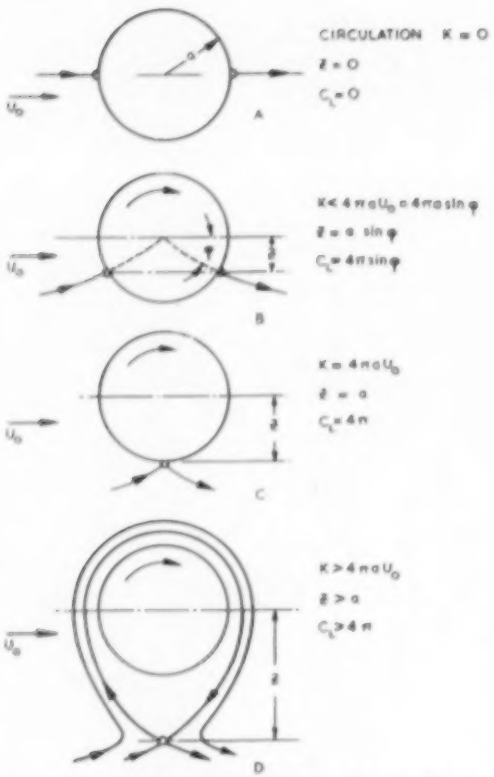


Fig. 12. Rotating cylinder in inviscid flow. Presence of a boundary layer would modify the lift values considerably. A, cylinder at rest, zero lift; B, moderate rotation; C, fast rotation; D, very fast rotation, stagnation point free within fluid.

HIGH-LIFT GENERATION . . .

method). But, apart from this, a circulation so strong as to produce a lift coefficient of 12.5 at only 21 deg incidence necessitates substantial flow around the tail of the aerofoil section, i.e., a stagnation point which is situated rather forward along the ventral side. This implies that, over a considerable proportion of the wing, flow opposes the direction of the undisturbed air. This reverse flow necessarily causes an extensive region of dissipative vortex formation and, hence, a very wide wake. This is typical for all assisted high-lift devices with extensive super-circulation (Fig. 16).

Regenscheit explains that, with his arrangement of suction at a cut-off trailing edge, a streamline is formed between the sucked-in air and the free airflow; this "rounds" the existing shape of the aerofoil tail (Fig. 14). The lift increase thus depends on the position of the stagnation point along the ventral surface. It is no longer a function of the incidence but of the quantity of air which is sucked in. The phenomenon was established in water-channel observations.

In this country, very similar ideas have been expounded by B. Thwaites. He proposes to use a symmetrical, thick aerofoil with a well rounded tail through which air is sucked in; around this tail, a flap can be deflected, and this flap is withdrawn into the aerofoil once the desired circulation is established. This would leave the aft stagnation point suspended in space, i.e., no longer attached to any firm surface. Such a floating stagnation point was formerly thought of as a hypothetical abstraction of theory. But theoretical proof was rendered that a stable circulation is attainable; also concluded from theory was that "static" lift could be expected under such conditions with the suction operating.

Experiments by D. M. Heughan indicate, however, that violent

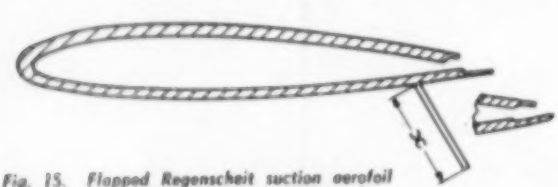


Fig. 15. Flapped Regenscheit suction aerofoil for very high lift (end discs not indicated).

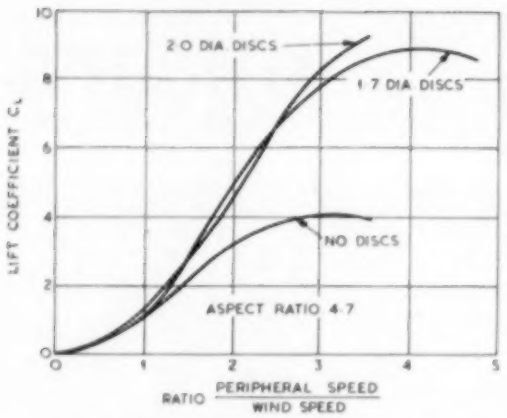


Fig. 13. Actual lift-coefficient values of a circular cylinder rotating in a wind-tunnel (Ackeret, Göttingen, 1924).

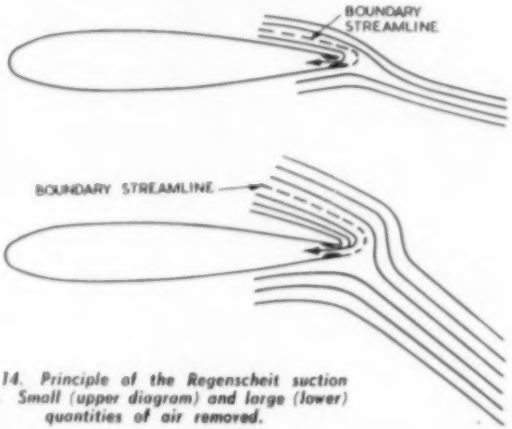


Fig. 14. Principle of the Regenscheit suction wing. Small (upper diagram) and large (lower) quantities of air removed.

flow instability sets in as soon as the flap is retracted, with fluctuating reversal of lift (Fig. 17). This is little surprising, since the aft stagnation point tends to approach the front one, for the reason that there is a tendency to increase the effective camber rather than to retain a virtual chord. It must, therefore, be concluded—at least, until further evidence is forthcoming—that steady circulation depends upon stagnation points located at surfaces of the aerofoil, as with Regenscheit's arrangement. Thwaites' scheme offers, of course, the advantage of a virtually deeper chord, and thus less likelihood of reverse flow along the ventral surface.

Rotating cylinders are thought incapable of providing static lift. For very high lift coefficients—values of the order of 22 are theoretically possible—they are deemed uneconomical, since the circulation increase is obtained by shear-strain transmission through the boundary layer; at high peripheral speeds, substantial energy-losses result. Besides, high circulations cause regions of reverse flow on the underside. Because of the comparatively smaller chord, these losses will already be incurred at lower C_L-values.

Stall Abolition.—In this direction several possibilities require investigation. Supercirculation gives independence from incidence (and also no gust sensitivity). This implies, of course, that the operating mechanism must not fail.

A second possibility is postponement of the stall to incidences unlikely to be reached operationally and remote from any normally

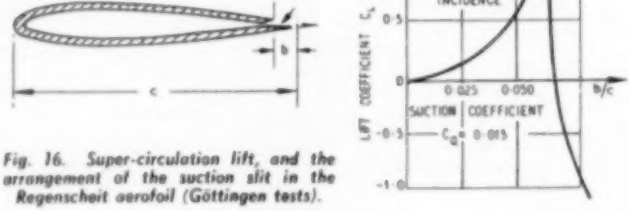


Fig. 16. Super-circulation lift, and the arrangement of the suction slit in the Regenscheit aerofoil (Göttingen tests).

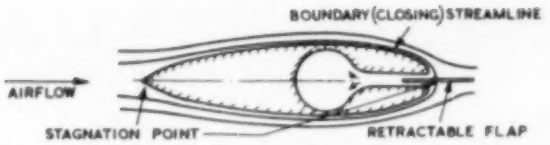


Fig. 17. Thwaites-type Glauert aerofoil ("lobster pot"), as tested by D. M. Heughan at Cambridge.

employed range. Certain wing arrangements offer this, however, at the expense of a low maximum lift coefficient.

Not sufficiently explored and yet most interesting is forcible compulsion of the boundary layer to follow the dorsal wing surface till it is shed from the actual trailing edge. The outside flow pattern must obey the laws of potential flow; thus no stall will occur. Suction slits can effect this, but at a price and not as perfectly as we should require. Discharge slots release high-velocity turbulent air to thicken and to speed up the boundary layer. Again, the stall is delayed but not abolished.

There are other possibilities for those who are not obsessed with the urge to reduce drag. For instance, one might increase, by artful means, the viscosity within the boundary layer. Heating or "lubricating" the boundary layer might be effective, though at the expense of profile drag. A decrease of the effective Reynolds Number with an increase of vorticity might prove quite beneficial. The boundary layer could be "dosed" so as to "stick" to the surface as viscous liquids do in torrents of air. A moving wing-skin would effectively prevent flow separation, as Favre in France showed 20 years ago. Aerodynamic tricks such as the Coanda effect may be invoked, in combination with other methods. Many ways are open for applied research.

There is no law of hydrodynamics which implies that flow separation (the stall) is a physical necessity associated with lift. The author believes that there is little cause to be complacent about the persistency with which the stall has afflicted all aircraft designed during 50 years of single-track development.

Static Lift.—More arguable is the problem of generating lift at aerofoils at zero forward speed. This is, of course, not possible without expense of mechanical energy.

Laboratory evidence, gathered whilst investigating power-assisted high-lift devices (in particular, those operating with discharge) proved that, when the high-lift mechanism is at work, lift is obtainable without an air stream. This is because air induced by the jet of a discharge slot acts in lieu of the air stream of a wind tunnel. This "static" lift is, generally, small, and was therefore left out of consideration. The theory of the Thwaites wing also established the possibility of static lift.

Some years ago, an American experimenter, W. R. Custer, demonstrated that his "channel-wing" aeroplane (Fig. 18) could lift itself when tethered, without direct lift from airscrews. The experiment has been repeated by the N.A.C.A., under strict conditions, in a full-scale wind tunnel and is thus confirmed (Fig. 19). Subtracting any direct airscrew lift (through up-tilt of the propeller axes, on account of incidence), and referring the lift coefficient to the mean inflow velocity of the propellers and to the projected area of the two "channel" wings parts, a maximum lift coefficient of 2.87 has been achieved during the N.A.C.A. tests, with the aircraft having an "incidence" of 19 deg against the ground. The ground influence was also measured, and was not responsible for the high static lift. Admittedly, the static lift of this Custer aeroplane is insufficient for a vertical take-off under load, apart from the aircraft not having any control provisions for this. Improved devices using forced circulation might well bring the possibility of vertical ascent and descent.

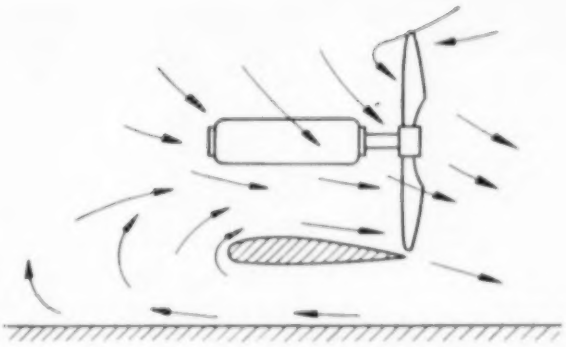


Fig. 20. Custer channel-wing aeroplane: observed airflow, with ground effect present. Zero forward speed and zero incidence against ground (N.A.C.A. observations).

At the Custer wing, the propellers induce and accelerate a flow of air over the aerofoil-cambered inside of a "channel" (Fig. 20); the latter is simply an aerofoil which is bent so as to form a semi-circle (seen from the front) open on top. Aerodynamically, the interesting feature of this arrangement is that the forced circulation is not effected by way of the boundary layer, as is general with common suction or blowing slots. Moreover, the acceleration of the dorsal flow by the propeller (the disc of which is in the plane of the wing trailing edge) probably prevents excessive dissipative flow around the trailing edge, i.e., it diminishes reverse flow along the ventral surface.

The significance of Custer's demonstrations has been generally overlooked, probably on account of the hullaballoo made by the helicopter crowd. Actually, to the author's knowledge, they have provided the first instance of "static" lift allowing the ascent of a full-size stationary aeroplane.

Other arrangements are possible, and may give more scope than those referred to here.

The satisfaction of requirements concerning high-lift and freedom from stall is, of course, part of the story only. The formidable problem of aeroplane control at low or zero speed has yet to be tackled. There is, however, no reason to presume that practical solutions will not be forthcoming, after some labour in research.

Nothing has been said here about jet-lift and flying furniture. The truth is that fiery jets of evil-smelling, flaming gases are neither attractive nor safe, nor economical enough except for very limited strictly military purposes (apart from the heavenly ascension of expendable prophets).

In the author's opinion a lot of life is still left in the old aeroplane. It offers fair prospects even in fields which are at present reserved for the helicopter, and in which the fixed-wing machine is undeveloped, on account of the one-sided orientation of present efforts. Progress in merging propulsive and lifting devices undoubtedly gives opportunities which could be profitably exploited; high-lift devices need not remain afterthoughts for rendering imperfect aircraft questionably efficient.

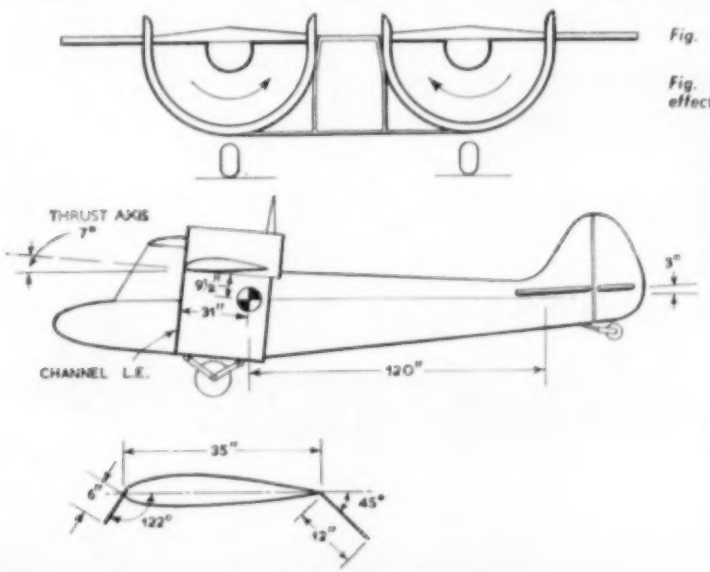
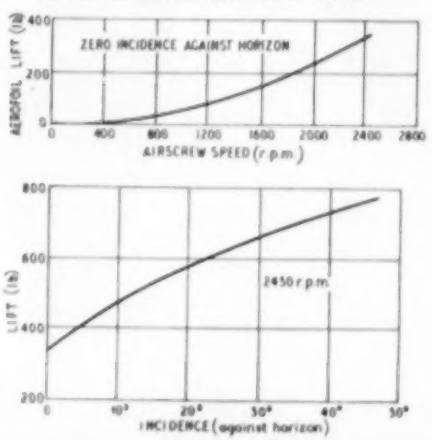
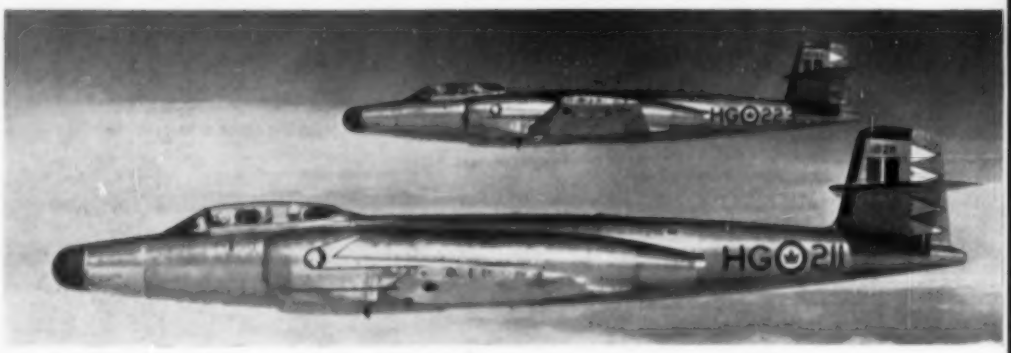


Fig. 18 (left). Custer "channel-wing" aeroplane (from N.A.C.A. description).

Fig. 19 (below). Custer static-lift performance. Ground effect absent; zero forward velocity; airscrew speeds and incidences as indicated (N.A.C.A. results).





The Mk 4 version of the Avro Canada CF-100 long-range all-weather fighter is now, as this photograph shows, in squadron service with the R.C.A.F. Fitted with belly packs containing eight 0.5in guns, the machines seen here do not carry wing-tip rocket pods.

AIRCRAFT INTELLIGENCE

Great Britain

English Electric Canberra. Many hundreds of Canberras have now been built by English Electric, Avro, Short and Harland and Handley Page. The most important types in production at the moment are the B.6 and P.R.7; nothing may yet be published regarding the progress of the B.8 towards production, or of the possibility of this machine being built by the Canberra Group firms. In the U.S.A., of course, several variants of the basic B-57 design have appeared.

Short S.A.4 Sperrin. Some readers will be familiar with the difficulty which has been experienced in finding methods for dropping stores out of bomb-bays of high-speed aircraft. Most of the troubles have arisen from aerodynamic buffeting, and this has sometimes been cured by fitting a small flap at the forward end of the bomb bay. The second Short Sperrin, VX 161, has been fitted with a ring of small plates around the front edge of the bomb bay, each plate being hinged about its forward edge in a manner similar to that employed in the cooling gills of radial piston-engines.

Canada

D.H. Canada Beaver Amphibian. An amphibious version of the Beaver, with floats and retractable wheels, is undergoing tests. Several flights have been made from Downsview and Toronto Island Airports, and although problems of buoyancy and ramp handling are reported to have been encountered, it is considered that eventual success would vastly increase the usefulness of the type.

France

Nord Production. The Nord 1203 Norecrin is by no means a new type (it was air-tested by the Editor of *Flight* as long ago as 1947); but a newly announced order for 20 of these three-seaters by a Swiss firm is some measure of the merit of the design. Delivery has already begun. The Nord 2501 Noratlas Packet-type freighter for the French Air Force continues in production, and of 140 ordered 53 had been delivered by December 15th. Of 110 N.C.856 Norvigie A.O.P.s, 52 had been delivered by the same date.

U.S.A.

U.S. Army Helicopter Competition. Nine companies have submitted tenders for a high-performance four-seater utility helicopter for the U.S. Army. The machine foreseen would rank between the present three-seater types and the 8/10-passenger Sikorsky H-19 (which also carries a crew of two).

General Electric V.T.O. Special turbo-jets for vertical take-off aircraft, and others equipped with thrust reversers, are to be tested by the General Electric company on a 4,500-acre site near Peebles, Ohio.

Switzerland

Close-Support Fighter. A new Swiss fighter prototype, designed for close-support operations from small high-altitude fields, should fly this year. The company responsible is said to be Flug and Fahrzeugwerke A.G. (FFA), the former Swiss branch of the Dornier concern, which is at present turning out Venoms and Vampires. A British powerplant is reported.

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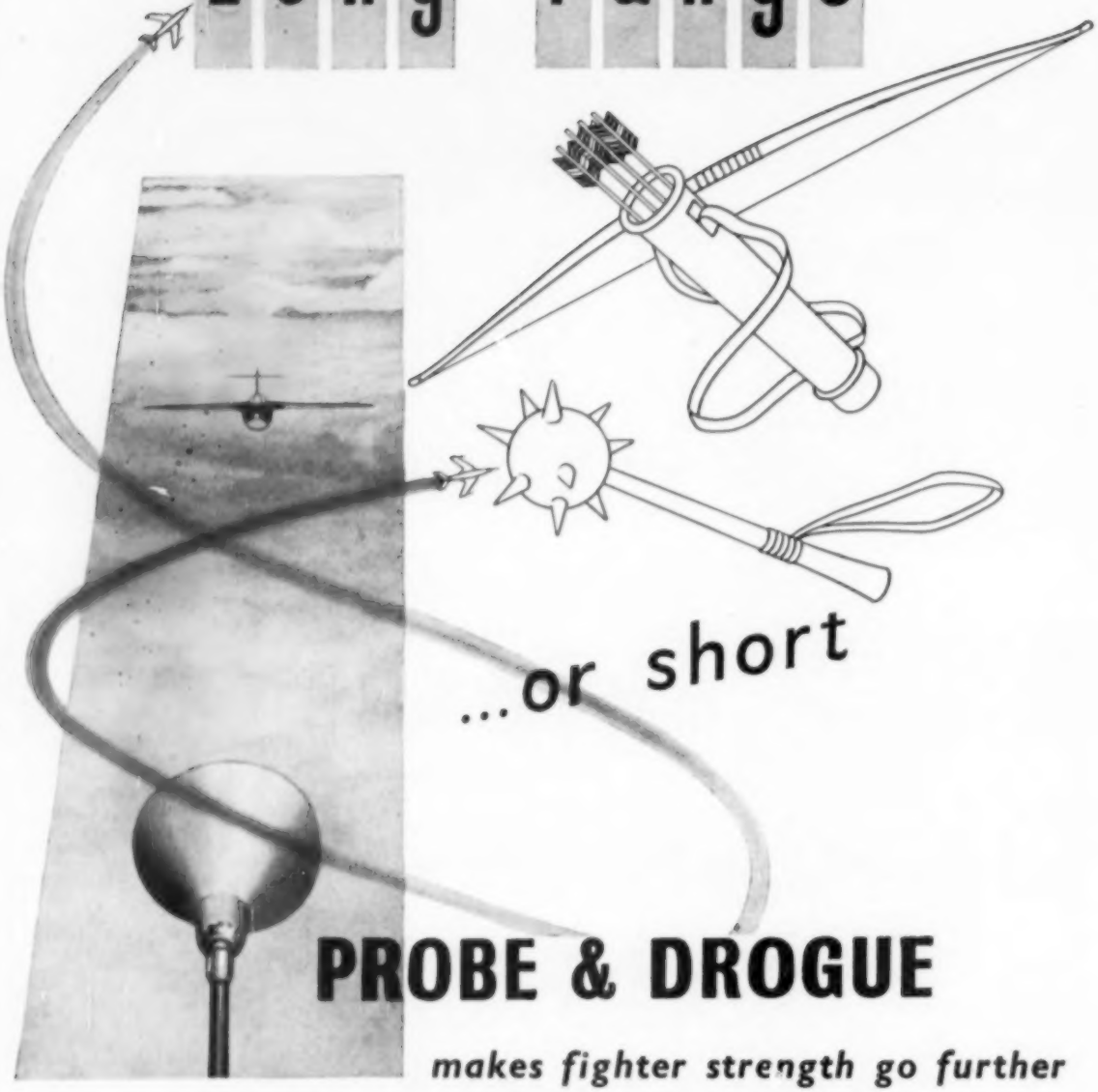

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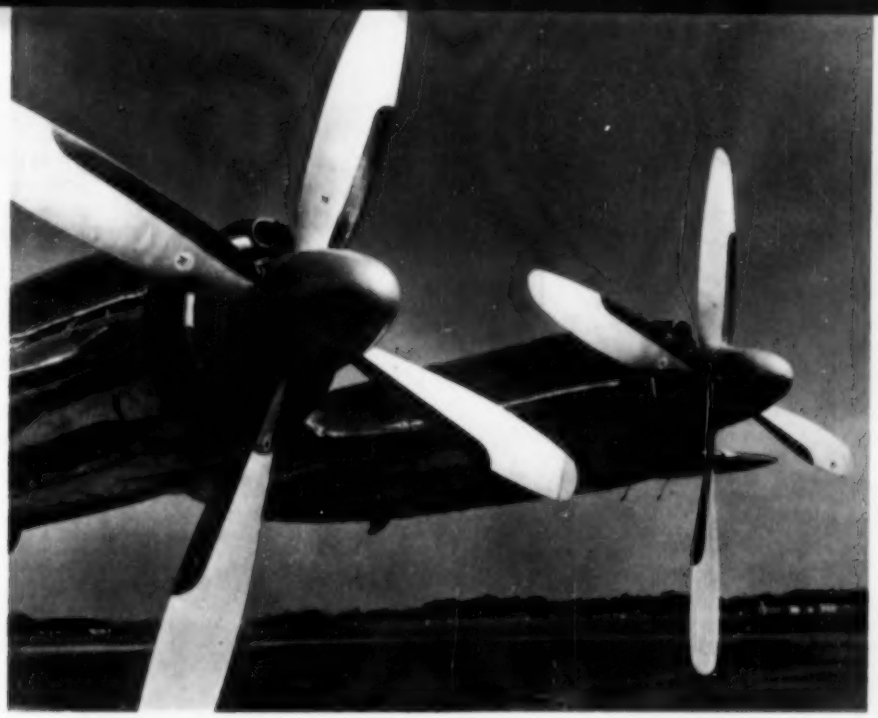


DART DEVELOPMENT

IMPRESSIVE RECORD OF THE FIRST CIVIL TURBOPROP: DETAIL CHANGES IN LATER MODELS

WITH the beginning of deliveries of Vickers Viscount aircraft to the American continent has come the introduction of turboprop travel to a much wider public. A glimpse at the operational record of the Rolls-Royce Dart, the engine which has made possible the success of the Viscount, can thus be considered appropriate at this time, together with an indication of the detail differences between Darts 505, 506 and 510.

It may be recalled that the original Dart engine was designed to produce 1,000 h.p. at the airscrew shaft, but that take-off power had been increased to 1,400 s.h.p. (plus a small amount of jet thrust) by the time the Viscounts entered regular B.E.A. service in March 1953. The engine has a two-stage centrifugal compressor, driven by a two-stage turbine; seven straight-flow combustion chambers; and an airscrew reduction gear ratio of 0.106 to 1.

In "The Story of the Dart" (*Flight*, March 20th, 1953) the basic design of the engine was described, together with the flying experience accumulated by B.E.A. on the prototype Viscount 630, the Dart-Dakotas and the prototype Viscount 700 up to the time the Viscount began regular airline service. The engine life between overhauls at that time stood at 400 hours.

The first 100,000 engine hours of B.E.A. operation were completed in June, 1954. Commenting on this period in a paper presented before the American Air Transport Association in San Francisco in October last, Mr. R. M. Cracknell, M.B.E., A.F.R.Ae.S., B.E.A.'s engine development manager, said, "In this short space of time, while maintaining high operating standards, large and possibly unprecedented economies have been effected. Power-unit overhaul life should shortly be trebled, many teething troubles have been overcome, maintenance costs have been substantially reduced, operating powers have been increased without detriment to reliability, and more efficient techniques together with a large number of modifications have been introduced to improve serviceability—all without seriously embarrassing operations."

The more important aspects of these developments described by Mr. Cracknell included overhaul-life increases (see diagram) and maintenance costs. Powerplant base maintenance costs—excluding engine overhaul expenditure—was less than 8 per cent of the total cost per aircraft flying hour, and routine powerplant maintenance amounted to under ten minutes per engine hour (less than half that for piston-engine maintenance). These figures had been achieved in spite of the expense and time necessary for introducing a new aircraft type; B.E.A.'s estimated development costs for the first four years of Viscount operation were not less than £1m.

Concerning reliability, the paper stated that experience had shown that incipient troubles in a turboprop tended to develop less rapidly than in piston engines. Of the total number of involuntary featherings experienced, only about 40 per cent had been due to the basic engine, equivalent to a rate of nearly 4,000 engine hours per incident. The engine failure rate was over 6,000 engine hours per removal. Miscellaneous power-unit flight snags were down to approximately one per 500 power-unit hours, about 2½ times less than for piston-engine aircraft.

Notwithstanding teething troubles, flight cancellations had been rare. The service delay rate due to engine troubles was down to approximately 1 in 200 flights. A measure of the total unscheduled work was given by the fact that component changes had been less than ten per thousand power-unit hours and, indeed, most of the items had been changed for precautionary reasons and had not given trouble during operation.

A number of specific examples of modifications made as a result of operational experience to improve the mechanical reliability of the engine were quoted by Mr. Cracknell. These included design changes to increase torquemeter reliability, improvements to reduction gear bearings (to increase life), combustion assembly alterations and a change in the oil specification (to improve starting reliability under cold-weather conditions), strengthened flame-tubes (to increase life), the introduction of increased load-carrying capacity turbine bearings (to improve reliability), simplification of interconnecting and fuel-trimming procedures, and elimination of exhaust-cone removals during power-unit overhaul life (by preventing undue mounting-pin wear). After describing B.E.A.'s use of the constant-r.p.m. and constant flame-temperature techniques for cruising power, Mr. Cracknell concluded by paying a tribute to the close collaboration that continued to exist between engine, aircraft and ancillary manufacturers and the operators.

For improved starting reliability, B.E.A.'s Darts are now being fitted with a high-energy ignition system, in place of the torch igniters in combustion chambers 3 and 7. Other advantages of the new system, the airline states, are easier air re-lighting (an emergency procedure only), improved flame-tube condition and, possibly, improved nozzle guide-vane condition.

The change-over from mineral oil to synthetic oil was also made in the interests of good cold-weather starting. The performance of the synthetic oil is in some respects superior to that

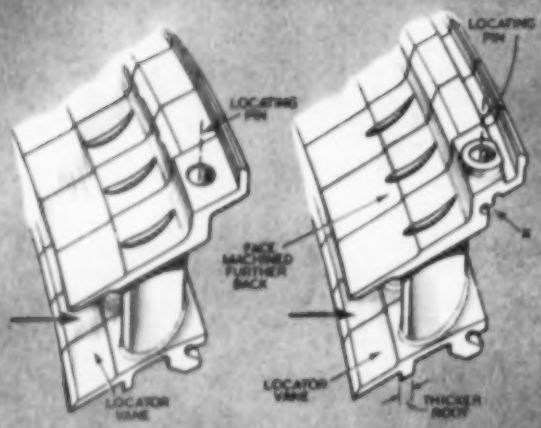
DART DEVELOPMENT . . .

of mineral oil, but two operational disadvantages, now being overcome, are that it is more destructive to normally insulated electrical cables in the event of leaks or spillage, and is about 15 times as expensive as mineral oil.

At one stage in B.E.A.'s Viscount operations, turbine-blade failures were experienced during ground running between 7,500 and 9,500 r.p.m. The cause was traced to resonance resulting from a small blade-dimension reduction authorized in connection with a particular manufacturing process, and an operating restriction was placed on this range until blades of the original dimensions had been fitted.

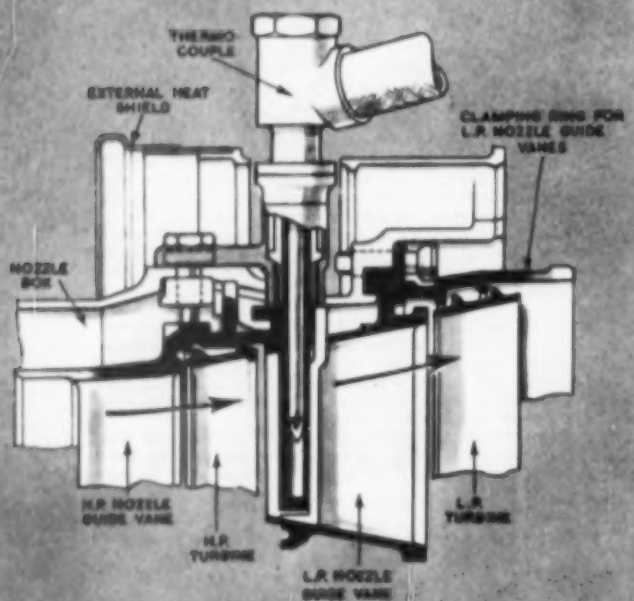
To guard against icing of the fuel filter, a fuel heater (operated by heated air from the second-stage impeller) has been introduced.

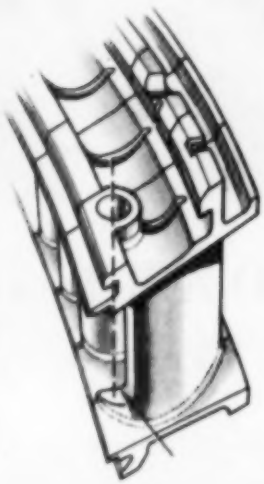
The low-speed gear-train on the Dart 510 reduction gear has wider, helical teeth. The annulus wheel on this type is bolted to the airscrew-shaft disc.



Detail differences between the h.p. turbine guide-vane shrouds on the Dart 505 (left) and the 510. Those of the latter have been re-shaped at X for the triple tip-sealing of the blades.

(Below) On the 510: Revised location of the thermocouple at the entry to the l.p. nozzle guide vane, and the triple tip-seals on both h.p. and l.p. turbine blades.





Modified l.p. nozzle guide vane on the 510, machined (at arrow) for sensing-head of re-positioned thermocouple.

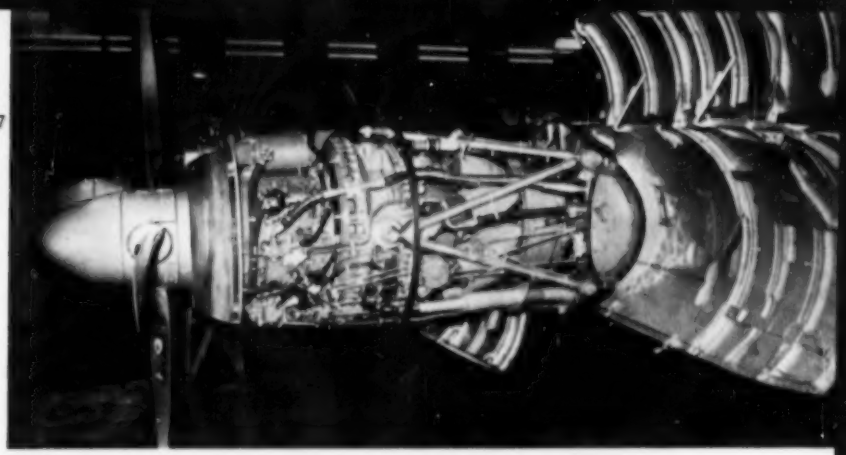
One major problem on the Dart has been the question of flame-tube life. Hot spots in the secondary-zone skin of the tubes made replacement necessary at between 500 and 750 hours. In the early days most of these tube changes could be made when the engine itself was being overhauled, but with the extension of engine overhaul life above 750 hours the problem became critical.

Rolls-Royce have introduced a succession of modifications to lower the flame-tube temperature and increase life. At present these modified tubes are variously in production, undergoing service trials or under development. In addition, salvaged tubes (in which a new section is welded on to the undamaged portion) have been made available; they have a life of some 550 hours.

The first modification (shown in the sketch above) was simply to weld a simple cooling strip inside the hot region of the tube. The downstream flange was designed to give the required cooling effect on the tube, and the upstream flange to cool the channel strip itself. The addition of this strip had a very marked effect on the temperatures of the flame-tube skin, as illustrated by temperature-patterns obtained by the use of thermal paints (two examples of these patterns are reproduced in diagrammatic form above, right). The improvement in temperature distribution was achieved without adverse effect on performance.

The main signs of wear, in the form of small cracks, appeared at the edges of those secondary holes which now passed through the cooling strip. In the next type of tube developed, therefore, these holes were re-positioned further downstream. Another development is to rivet the cooling strip in position, instead of welding it. The riveting method allows relative movement between tube and strip, but the proximity of the turbine blades demands absolute certainty that the rivets will stay in place: Rolls-Royce have not finally decided which system is preferable, but at present they favour welding.

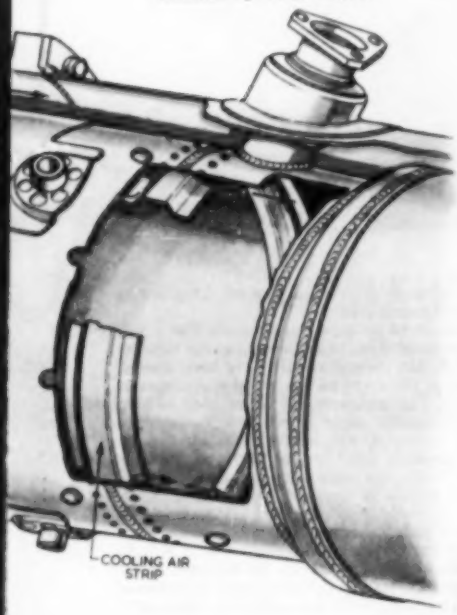
The next step involved a change in the external shape of the flame-tube, the adoption of an extended flare head, and the addition of a second strip. The tube—giving a different diffusion-rate—was now of simplified cylindrical shape, the "neck" between

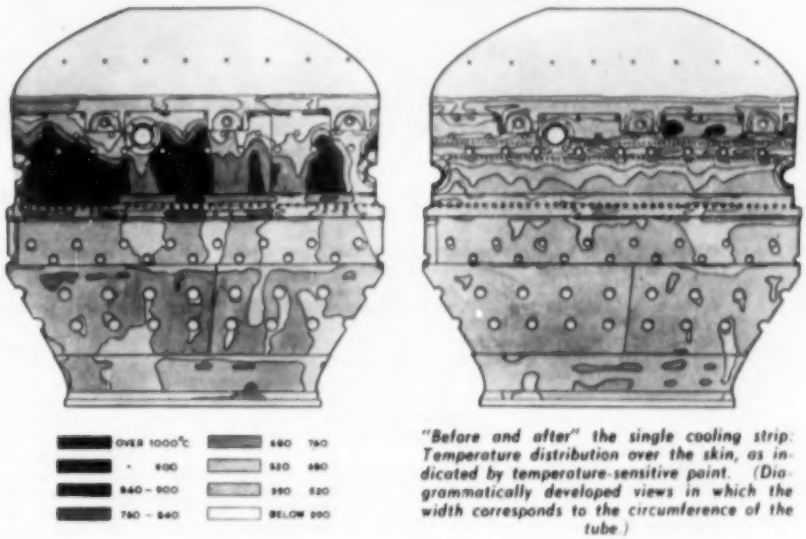


T.C.A.'s first Viscount, CF-TGI, recently delivered, is also the first to be fitted with Dart 506s. This view of the port outer shows well the engine installation and cowlings. "Flight" photograph

The incorporation of a cooling strip on the inside of Dart flame-tubes did much to improve tube life (see also temperature comparison, centre right). Air entering through the downstream row of holes cools the tube; air through the other row cools the strip itself.

"FLIGHT" copyright sketches by V. R. Berris





"Before and after" the single cooling strip: Temperature distribution over the skin, as indicated by temperature-sensitive paint. (Diagrammatically developed views in which the width corresponds to the circumference of the tube.)

tertiary and secondary zones having been removed: again the two cooling strips could be either welded or riveted in place.

The furthest advanced Dart flame-tube at present contemplated by Rolls-Royce retains this smoother contour, and has in addition a third cooling ring. This is situated downstream, with the object of reducing still further the hot areas in this region. Of these modified designs, the first is now in production at Derby and both single and double-strip types are undergoing service trials with B.E.A.

The Dart 506.—The engines in B.E.A. Viscounts to date, and to which the earlier remarks apply, are Dart 505s (RDa.3). Rolls-Royce development engineers had been working for some time on an improved Dart intended to give greater all-round power: it was not considered opportune for B.E.A. to convert its Viscount 701s to this type of engine (a new reduction gear would have been necessary to cope with the increased take-off power)—but it was decided that the introduction of a part-modified Dart, giving enhanced cruise performance, would be well justified.

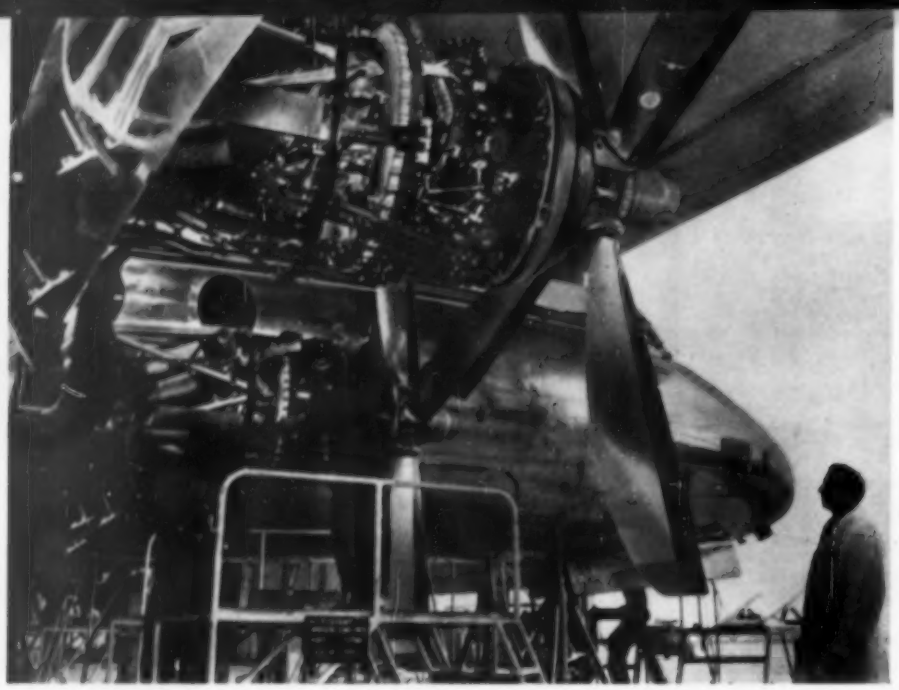
This version is the Dart 506. Two main aerodynamic improvements in component design give an increase in normal cruise power of about 4 to 7 per cent and a decrease in cruise fuel-consumption of some 5 per cent. With the same reduction gear as the 505, the increased power is not available for take-off (the same reduction gear has already accommodated the 400-s.h.p. increase in take-off power since the original 1,000 s.h.p. Dart rating)—but the use of water-methanol injection as an aid for take-off on B.E.A. Viscounts is now needed only above I.S.A. + 11 deg C instead of above I.S.A. conditions.

One design modification on the 506, illustrated on the right, is the thinning-down of the leading edges of the rotating guide-vanes of both compressor stages, together with the polishing of the vanes in place of the original shot-peen finish. The other is the introduction of an increased space/chord ratio on the high-pressure turbine nozzle guide-vanes, giving better turbine efficiency.

Thus, the 506 can give the same 1,400 s.h.p. for take-off while

THIN ROOT ON LEADING EDGE
POLISHED BLADE FACES
BLADE SECTION THINNER AT THIS POINT
THICKER ROOT ON LEADING EDGE
SHOT-PEENED BLADE FACES
THICKER BLADE SECTION

By refinement in 505 component design, Rolls-Royce have achieved greater cruise power and improved economy on the 506. Here details of the respective rotating guide-vanes (506 upper) are shown.



Routine maintenance: The Dart 505s of one of B.E.A.'s Viscounts undergoing a Check 3 inspection at London Airport.

DART DEVELOPMENT . . .

running at a lower temperature than the 505: at cruise, more power is produced at the original running temperature. Minor changes in the fuel system have been made to allow for these differences. High-energy ignition is standard on the 506.

Modification of B.E.A.'s Darts to 506 standard is to be carried out during the next few months. Estimated increases in available payload and in cruising speed for the Viscounts are approximately 800 lb (on stage-lengths over 800 n.m.) and 12 kt respectively. The first of T.C.A.'s Viscounts was the first to be equipped with the 506, and the first few Viscounts for Capital Airlines will have the 506 model. As indicated, the mechanical differences between 505 and 506 are relatively slight.

The Dart 510 (RDa.6).—To be introduced on the first Central African Airways Viscount later this year, to be fitted on the majority of Capital's Viscounts, and scheduled for B.E.A.'s Viscount 802s, is the Dart 510. Continued component-development is designed to give on this type improvements in performance over the full operating range of the engine.

The main changes in design are all illustrated in this article. In the redesigned reduction gear the low-speed gear train is now helical, instead of spur type, the teeth are wider, and larger load-carrying bearings enable the increased take-off power of 1,550 h.p. (at the 505's flame temperature) to be utilized—and more if required. The method of attaching the annulus-wheel flange to the airscrew shaft disc is now by means of bolts. The ratio of airscrew shaft speed to turbine speed is reduced from 0.106 to 0.093, resulting in lower tip-speeds and decreased noise levels under all conditions, as cruise and take-off r.p.m. remain unchanged at 1,360 and 1,450 respectively. There is the possibility, in which B.E.A. are interested, that the engine may be cleared ultimately for an increase of revs on take-off, in order to retain the original airscrew conditions.

On earlier Darts, indication of jet-pipe temperature was given by means of thermocouples located in the gas stream at the exhaust cone. On the 510, however, the thermocouples have been moved forward and are now fitted at the entry to the low-pressure nozzle guide-vanes (see diagram). This arrangement is designed to give an engine temperature indication more closely proportional to flame temperature and, it is hoped, will lead to simplification in engine handling and the possible development of automatic control. The installation of triple tip-seals on both high-pressure and low-pressure turbine blades is another modification incorporated on the 510.

In view of the fact that a number of operators will be accumulating flying hours on this engine prior to its service with B.E.A., a fairly quick rise in overhaul life is expected. In addition to the improvement in take-off power, sea-level cruise power is increased to 985 total equivalent h.p., and cruise consumption reduced to 0.635 lb/t.e.h.p./hr on the 510.

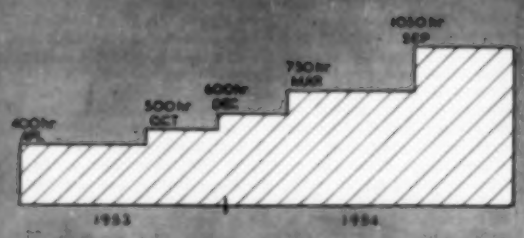
Little can be said at this stage concerning the RDa.7, a further-developed Dart intended to provide 1,800 to 2,000 s.h.p., prototype versions of which have been reportedly offered for delivery in about three years. Many lines of development are being studied by Rolls-Royce engineers, but it appears certain that the RDa.7 design will incorporate a three-stage turbine, and shrouded impellers to prevent air leakage over the vanes.

As indicated, the development life of the Dart is far from complete. At the present time, and with a further increase in the overhaul life of existing Darts probable in the near future, the impressive total of Dart hours already flown is easily overlooked. It is worth recording that this total—nearly 150,000 hours of which have been flown on regular airline service by B.E.A.—is now over a quarter of a million hours.

K.T.O.

Dart performance development: A comparison of take-off powers, typical cruise powers and fuel consumption between the 505, 506 and 510. Production of the 505 and 506 began in January 1953 and June 1954 respectively: for the 510, June of this year is the scheduled production date.

Increase of approved overhaul life for the Dart. A further increase to 1,200 hr is expected for the near future.



On their fleet

of sixty Vickers Viscounts

powered with

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will use ....

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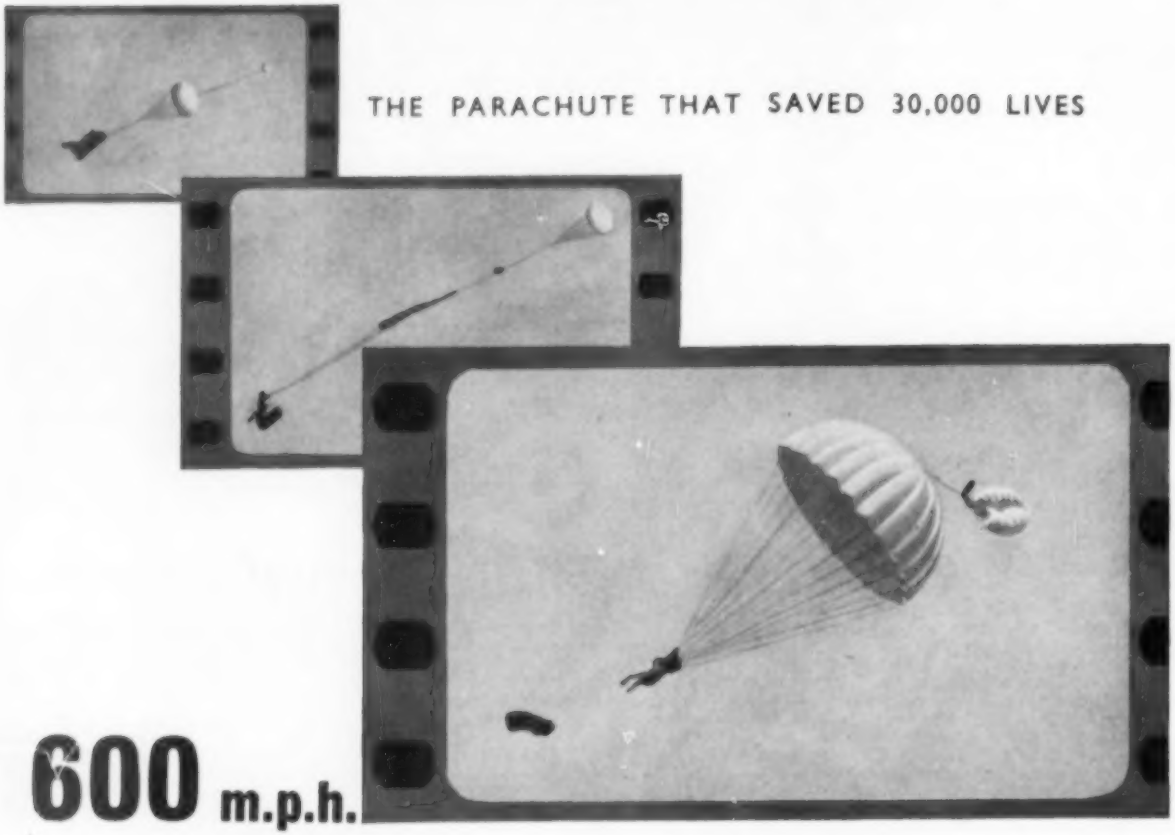
THE PARACHUTE THAT SAVED 30,000 LIVES



600 m.p.h.

at ~~150 feet~~ *50 feet*

—still the safest parachute

In a ~~recent~~ *more recent* test of a Martin-Baker Patent fully Automatic Ejection Seat, an ejection was made from a Meteor 7 aircraft in straight level flight at 600 m.p.h. and only ~~150~~ *50* feet up. Three seconds after ejection this IRVIN 24-feet parachute was fully deployed before alighting. It was this same canopy design that saved the lives of 30,000 airmen during the war.

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TRANSONIC TRAINER

AS a private venture, North American Aviation, Inc., have developed a dual-control trainer version of the Sabre, with instructor and pupil seated in tandem. Most of the major assemblies of the TF-86 are identical with those of the F-86F fighter, but the length of the fuselage has been increased by six feet.

The instructor sits behind his pupil, his forward vision being improved by the fitting of a retractable head-rest to the front seat. Each cockpit has a standard tilted instrument-panel system, with three types of lighting—rim, emergency flood and thunderstorm. Electronic equipment can be switched for control by either pupil or instructor, the latter having final overriding control. The fuel system has been greatly simplified—fuel is either "off" or "on," and tank selection is automatic—as also has the ejection procedure, effected merely by raising the seat hand-grip (to eject the canopy) and firing the seat. Ejection can be made through the canopy if necessary, and drogue release is automatic.

The power unit of the TF-86 remains the standard J47-GE-27, with a 6,100 lb-thrust sea-level military rating. The flying-control system is also of the standard Sabre fully powered irreversible pattern; and, though the trainer does not have the "slick" wing, it retains the leading-edge slat of earlier Sabres.

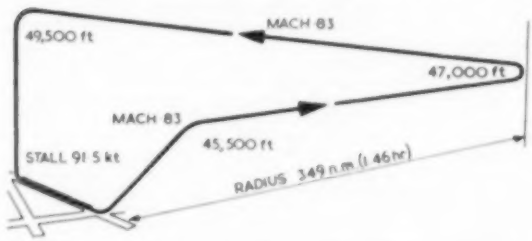
Among the variety of equipment specified for the TF-86 are a pair of 0.50in guns each with 100 rounds, installed in the position normally occupied by the bottom pair of guns in F-86Fs; an AN/APG-30 radar equipment, A-4 gunsight and N-9 reticle camera; and kits of external stores, including bomb racks or eight rocket launchers. For "touch-and-go" circuits, over two hours' sea-level endurance can be gained by carrying a pair of 200-U.S. gal drop tanks.

A photograph of the one and only TF-86 was published in our issue of September 3rd last. Externally, the principal difference between this aircraft and the single-seat Sabre F-86F (apart from the longer nose and canopy) is the addition of a long stabilizing strake following the ventral centre-line of the rear fuselage. The TF-86 has completed a lengthy programme of demonstration flying and touring U.S.A.F. bases, but no plans for production have yet been announced.

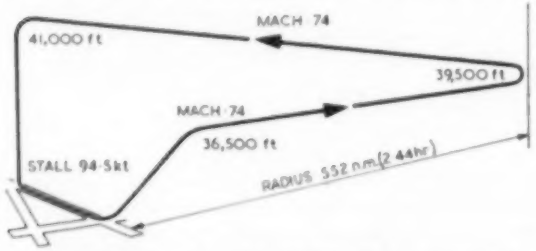
The accompanying sketches and data are presented not by reason of any singular importance attaching to the aircraft but largely because such detailed information cannot be given for any other comparable machine.

	Pilot Trainer		Gunnery Trainer		Fighter Bomber Trainer
	Clean	With tanks	Clean	With tanks	Tanks plus T.1.
Take-off weight (lb)	14,836	17,790	15,106	18,060	18,380
JP-4 fuel at 6.5 lb/gal (lb)	3,094	5,694	3,094	5,694	5,694
Payload (ammunition) (lb)	—	—	60	60	60
Wing loading (lb/sq ft)	51.4	61.7	52.4	62.6	63.8
Stalling speed (power off) (kt)	101.5	111.5	102.5	112	113
Operational take-off speed* (kt)	112	123	113	123	124
Take-off ground run at s.l. (ft)	1,680	2,580	1,750	2,720	2,800
Take-off to clear 50ft (ft)	2,640	3,800	2,720	3,940	4,080
Rate of climb at s.l.* (ft/min)	8,825	6,000	8,640	5,860	5,660
Maximum speed at s.l.* (kt)	601	550	601	550	532
Range (n.m.)	698	1,123	682	1,103**	—
Radius (n.m.)	349	562	341‡	552‡	359§
"Effective combat" weight (lb)	12,980	14,610	13,240	14,890	15,755
Combat altitude (ft)	35,000	35,000	35,000	35,000	s.l.
Combat speed* (kt/Mach No.)	531/.921	497/.865	531/.925	496/.863	533/.808
Combat climb* (ft/min)	2,675	1,450	2,600	1,375	6,650
Combat ceiling* (ft)	47,500	41,300	47,000	40,900	38,600
Service ceiling* (ft)	50,500	43,800	50,000	43,600	41,400
Rate of climb at s.l.* (ft/min)	10,300	7,550	10,050	7,400	6,650
Landing weight (lb)	12,051	12,665	12,321	12,935	13,255
Ground roll (ft)	2,080	2,190	2,140	2,240	2,300
Total from 50ft† (ft)	3,220	3,350	3,280	3,400	3,470
Stalling speed† (kn)	91.5	93.5	92.5	94.5	95.5

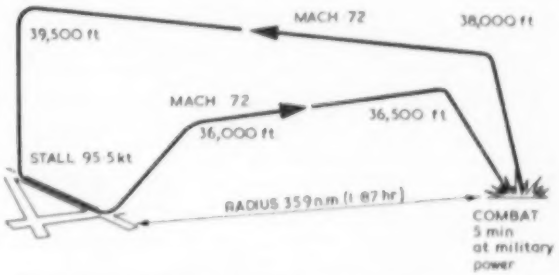
* Military power. † Idle power. ‡ Computed per MIL-C-5011 with no combat allowance. § Computed per MIL-C-5011 with appropriate combat allowance. ** If tanks are jettisoned when empty, maximum range will be increased by 175 nautical miles.



Basic mission (modified) without external fuel: take-off at 112 kt after 1,680ft ground run; 476 U.S. gal fuel (10 per cent reserve).



Gunnery mission with two 200 U.S. gal tanks retained: t-o at 123 kt after 2,700ft ground run; if tanks dropped, radius 640 n.m. in 2.81 hr.



Fighter/bomber trip, with tanks and two T-1 bomb packages: t-o at 124 kt after 2,800ft run; total fuel 876 U.S. gal (10 per cent reserve).

DECARBONIZING IN SITU

EQUIPMENT for blast-cleaning cylinder heads of aero-engines without dismantling, called the Aero Power Combustion Chamber Cleaner, has been developed in the U.S.A. by Kent-Moore and is being marketed by Rice Peterson Sales of Palo Alto, California. A non-corrosive, non-abrasive cleaning agent is blown into the cylinder through an adjustable nozzle fitted to a spark plug port. Carbon which is thus dislodged is then extracted through the other port and deposited in a disposable bag. Early trials on Hiller UH-12B helicopter engines are reported to have shown an increase in power and climbing performance of about 11 per cent after cleaning by the process.

Carbon-removal by blast-cleaning is not in itself a new practice. It usually involves the use of a sharp, granular material; coarsely ground nutshells are sometimes employed.

METALLURGICAL HONOURS

AWARDS of medals by the Institute of Metals have been announced as follows: the Institute's platinum medal for 1955 to Dr. C. J. Smithells, M.C., F.I.M., Director of Research, British Aluminium Co., Ltd., "in recognition of his services to metallurgical science, to the metal industries, and to the metallurgical profession"; the Rosenhain medal for 1955 to Dr. W. A. Baker, F.I.M., research manager, British Non-Ferrous Metals Research Association, "in recognition of his outstanding contribution to knowledge in the field of physical metallurgy, with special reference to the influences of gases and shrinkage on the soundness of cast metals"; and the W. H. Robertson Medal and premium for 1954 to Professor H. Ford and Mr. J. G. Wistreich for their paper on *Problems of the Control of Dimension, Shape and Finish in Rolling of Sheet and Strip and Drawing of Wire.*

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Ultra-light Flying-boats

IN your issue of November 19th, 1954, you stated, under the heading "Cockleshell," that the world's smallest flying-boat had been built by Turre Eklund of Finland.

One flying-boat which was smaller (though I do not know whether it was the smallest ever) was the Dutch pre-war Scheldemeeuw, with a span of only 22ft and a top speed of some 75 m.p.h. only. Power was, if my memory serves me right, a Praga two-cylinder engine of 40 h.p.

Perhaps others among your readers know of still smaller flying-boats?

Jerusalem, Israel. N. KADMON.

[Although the Scheldemeeuw was shorter in span than the Eklund, the latter is a few inches shorter in length. The engine is a 40 h.p. Continental, whereas the Scheldemeeuw, as our correspondent rightly recollects, had a 40 h.p. Praga.—Ed.]

Aircraft in the Antarctic

WHILST loth to prolong the discussion, I really must protest at Capt. von Essen's construction placed upon the letter of mine which you were good enough to publish in your issue of November 12th. Far from chastising Capt. von Essen, my criticism was aimed entirely at the article which gave rise to his original letter to you. If he would re-read my letter, in conjunction with the second sentence of the penultimate paragraph of Mr. Scholes' article, I do not think he will find it difficult to follow the aim of my remark—deploring any comment tending to give the Queen Maud Land Expedition an appearance of international rivalry, that is, by mentioning the air contribution only of the R.A.F. to the Expedition's work, and crediting to the R.A.F. work actually carried out by the Swedish Air Force.

The cap in question was never designed for Capt. von Essen's wear.

London, W.1. JOHN GRIERSON.

"Cash and Carry"

THE daily Press gave considerable space at the time to this incident [a late-arriving passenger's exclusion from a Viscount —Ed.]; this was, perhaps, understandable in view of the identity of the passenger concerned. When, however, an aviation journal such as *Flight* devotes its second leader to the occurrence and expresses itself as being sympathetic towards a would-be air traveller who arrived nineteen minutes after the published check-in time for his flight, what else can we do but echo the words of Cæsar and murmur sadly, *Et tu, Brute?*

Since *Flight* is fully aware of the amount of documentation required before an aircraft embarks on an international journey, and agrees, we are sure, that punctual operations are desirable, no lengthy explanation of the action taken in this case should be necessary.

With the remainder of your leader—the time taken for the clearance and completion of air-freight papers, the operation of airline coaches and the necessity for flexibility in dealing with passengers who "slightly overstep" check-in deadlines—we are in general agreement. However, in regard to the check-in times, there are limits beyond which carriers cannot go without abandoning the maintenance of the discipline that schedules are designed to impose both in the interests of the travelling public and of the air companies themselves. DAVID HAYES,

Dublin. Public Relations Officer, Aer Lingus.

Pressurized-aircraft Tests

ALTHOUGH the matter is of no immediate concern to me, being only a Rapide pilot, I would be very interested if I could be enlightened on the reason why, in the cabin pressurization considerations which were so much in the news recently, no mention was made of the familiar aerodynamic suction which is created outside certain parts of the cabin in flight.

This suction would accentuate locally the pressure differential to a value higher than that allowed for in tests under static conditions. Even cockpit instruments in flight would record the difference between the internal pressure and that in a static vent, but would not reveal the fact that there may be over-strained areas.

Does it not seem preferable, therefore, to conduct pressurization tests in a wind-tunnel rather than in a water tank?

Liverpool, 18. O. WEISZ.

[Aerodynamicists are aware of the dynamic pressure distribution; in comparison with cabin pressure difficulties, we believe, the values are insignificant.—ED.]

Mudros Memories

MY late father was an R.N.A.S. gunner on one of the sixteen A.A. guns mentioned by Mr. Bruce (October 29th), and his scrapbook provides further evidence on the R.N.A.S. Sopwith triplane No. N 5431.

The photograph of its crash at Salonika confirms Mr. Bradley's statement (November 12th) that the airscrew blades were broken off at the hub, and the crankcase undamaged. The second photograph shows the aircraft at Mudros, fitted with an airscrew having sharply curved leading edges and straight trailing edges, as opposed to the more conventional blade form shown in Mr. Bradley's photograph. Having searched through old "R. & M.s" at the R.A.E., where I am employed, I find that this pattern of airscrew may well be an Air Ministry design which was of laminated construction. Other pictures in the scrapbook show similar airscrews on the Sopwith machines of "F" Squadron at Stavros, led by Lt. (now G/C.) Smyth-Piggot, D.S.O. Perhaps it was this airscrew which finally came to rest in the monastery at Batchkovo.

Incidentally, Mr. Bruce may be interested in other photographs in this scrapbook, e.g., of the old kite-balloon ship, H.M.S. *Canning*, which, after a short spell of service in that area, was used to convey to England the wreckage of a Zeppelin shot down by A.A. fire at Salonika. Further snaps show various German aircraft shot down in the area.

Aldershot, Hants. A. R. METTAM.

FORTHCOMING EVENTS

Jan. 14. Helicopter Association: Brains Trust.
Jan. 15. British Interplanetary Society (North-West branch): "High-Speed Flight," by R. J. Boor, A.M.C.T.
Jan. 15. Women's Engineering Society: New Year luncheon.
Jan. 18. R.Ae.S. Section lecture: "Manufacture of Integral Structures," by Dr. E. G. West, Ph.D., B.Sc.
Jan. 22. British Interplanetary Society (provisional Yorkshire branch): Short-paper evening.
Jan. 22. British Interplanetary Society (provisional Western branch): "Engineering Problems in the Construction of Satellite Vehicles," by G. L. Garthwaite.
Jan. 24-28. Institute of the Aeronautical Sciences: 23rd Annual Meeting and Honors Night dinner, New York.
Jan. 25. British Interplanetary Society (provisional Scottish branch): Brains trust.
Jan. 25. R.Ae.C.: Film show.
Jan. 25. R.Ae.S. Graduates' and Students' Section lecture: "Test-flying a V-bomber," by S/L. H. G. Hazeldon, D.F.C. and Bar, and R. H. Williams, B.Sc., A.F.R.Ae.S.
Jan. 26. R.Ae.C.: Dinner to 1954 British Air Racing Champion and winner of 1954 King's Cup Air Race.
Jan. 27. R.Ae.S. Section lecture: "Dynamic Problems of Interplanetary Flight," by D. F. Lawden, M.A.
Feb. 1. Institute of Transport: Informal luncheon.
Feb. 2. Royal United Service Institution: "The Greenland Expedition," by Cdr. (L) C. J. W. Simpson, D.S.C., R.N.
Feb. 2. Women's Engineering Society: "The Work of the British Standards Institution," by L. G. Wathins.
Feb. 5. British Interplanetary Society: "The Development of the Snarler Rocket Motor," by D. Hurden, B.A., Grad.I.Mech.E.
Feb. 5. British Interplanetary Society (Midlands branch): "The Atmosphere and Space-ship Design," by A. H. Wickens, B.Sc., D.L.C., Grad.R.Ae.S.
Feb. 8. R.Ae.S. Section lecture: "Some Trends in the Development of Aircraft Electrical and Starting Systems," by R. H. Woodall, F.R.Ae.S.
June 10-19. Paris Aero Show.

R.Ae.S. Branch Fixtures (to Feb. 3):—

Jan. 17, *Halton*, "Compound Engines," by E. E. Chatterton. Jan. 19, *Coventry*, illustrated talk by Dr. A. M. Ballantyne on visits to overseas divisions of the Society. Jan. 20, *I.O.W.*, "Titanium," by Maj. P. L. Teed.

Jan. 24, *Henlow*, "The Large Transport Helicopter—its Design Problems," by Dr. G. S. Hislop. Jan. 25, *Belfast*, "The Helicopter—has it a Future?" by F. H. Robertson. Jan. 26, *Preston*, "Domain of the Helicopter," by R. Hafner; *Weybridge*, "Fuels and Lubricants for Aviation," by Dr. C. B. Davies. Jan. 27, *Yeovil*, "History of Helicopter Patents," by L. H. Hayward.

Jan. 31, *Halton*, Junior Members' night.

Feb. 2, *Chester*, "Global Winds and Weather," by C. S. Durst; *Brough*, "Air Accidents," by A. Cdre. Vernon Brown; *Luton*, "Controls and Stability," by J. Wimpenny; *Southampton*, "The Lightweight Jet Engine," by Dr. S. G. Hooker. Feb. 3, *Cheltenham* (area lecture: Coventry, Birmingham, Gloucester and Cheltenham branches), "Comparisons of Some Aircraft Propulsion Systems," by Prof. A. D. Baxter.

TWINS MEAN BUSINESS

American Light Twin-engined Executive Aircraft Reviewed

The Cessna 310, in the air, shows the generous proportions of its tail surfaces. Tailplane span is no less than 17ft.

TWO recent *Flight* assessments of typical American light twin-engined executive aircraft (Beech B50 Twin Bonanza, December 31st; Aero Commander, December 24th) serve as reminders of the advanced state of development of such aircraft for executive transport in the U.S.A. In fact the majority of American light aircraft are used for business purposes, and many very much larger machines have been specially converted.

A key factor in the selection of such aircraft, quite obviously, is their availability for use when business calls rather than when weather permits, and for this reason something approaching full-scale airline radio and radio navigation equipment is essential. Though even Piper Pacers often carry fairly comprehensive aids of this kind they do not offer quite the amenities and cruising/range performance of, for example, the light twin, and it is the latter type which in recent years has emerged as one of the basic executive air-transport vehicles in the U.S.A.

American business-aircraft owners have formed themselves into a body called the National Business Aircraft Association, and at Love Field, Dallas, Texas, last October, the association held its seventh annual convention. This was attended by 435 delegates, almost twice as many as last year, and some $5 million worth of new executive aircraft were exhibited for their benefit by manufacturers and dealers.

Steadily increasing use is being made of "corporate aircraft," i.e., aeroplanes owned by companies for executive transport purposes, and the N.B.A.A. aims to supervise and co-ordinate the operation of such machines, and to protect their status in aviation law. During the various meetings at Love Field a variety of subjects was dealt with, and suggestions were exchanged between Civil Aeronautics Authority and N.B.A.A. representatives. Forms of insurance for pilots, training schemes and piloting standards, navigation aids and traffic facilities were all discussed, especially with a view to maintaining the recognition of executive aircraft as *bona fide* airways users. It was particularly suggested that all operators should install VOR/DME equipment, since the coverage in the U.S.A. was now complete except for four small blind patches at 20,000ft. The scope of these executive aircraft operations is considerable, and their value to the companies concerned was amply demonstrated at the convention.

The great variety of types of aircraft currently used for business ranges from the modest Piper-type light aircraft to the "super-de-luxe" pressurized conversions of World War 2 bombers, brand-new executive Martin 202s, and such aircraft as DC-3s re-engined with P. and W. R2000 or P. and W. 1830-94-M1. At least two variants of these latter conversions were on show. Also to be seen were various Lockheed Lodestars, Beech 18 and Super 18 and the compound Learstar. Three foreign products were shown. One was the de Havilland Heron, which sells at $195,000 (about £69,500) and is very popular. Another was the de Havilland Dove which, though not dealt with in detail here, since it is not of American origin, holds an important position in the light twin field, and is well liked. More than 80 Doves have now been sold in the U.S.A. The third was the Piaggio P.136L amphibian, *alias* Royal Gull, which is assembled in America by the Royal Aircraft Corporation, Milwaukee, and sells for $65,000 (about £2,330). It was briefly described in *Flight* on November 19th. Another amphibian on show was the Grumman Super Widgeon; considerable interest has been shown in these amphibians by oil companies who would find them useful for personnel and light freight transport between the shore and oil-drilling rigs erected at sea.

In a class of its own, however, is the series of light twins selling at between $35,000 and $69,000*, with seating capacities from four to eight, offering good cruising speeds and ranges often over 1,000 miles. They are, in order of price, the Piper Apache (170 m.p.h., $35,075), the Riley '55 Twin Navion (180 m.p.h., $36,500), the Cessna 310 (205 m.p.h., $50,000), the Aero Commander 560 (197 m.p.h., $69,500), and the Beech Twin Bonanza C50 (200 m.p.h., $69,950). All these have metal construction, tricycle undercarriages, variable-pitch airscrews, horizontally opposed engines, comprehensive radio-navigation equipment, a smart appearance, and a long and varied list of comfort and safety features.

Only one of them is in the direct sense a conversion of its single-engined predecessor, namely the Riley '55, which was originally the Ryan Navion. Its production was taken over

**Approximate sterling equivalents for dollar amounts quoted in this paragraph are:* $35,000, £12,000; $69,000, £24,700; $35,075, £12,527; $36,500, £13,050; $50,000, £17,800; $69,500 £24,800; $69,950, £24,960.

The only high-wing light twin, the Aero Commander sits very low on the ground. The under-fuselage is specially strengthened to take an emergency belly landing with the minimum damage.

"Flight" photograph

With one airscrew feathered (note also large rudder-trim tab) the Piper Apache, fully loaded, has a 5,000ft plus ceiling.

TWINS MEAN BUSINESS . . .

successively by a number of companies, the latest of which is Temco. This concern has developed a production-line conversion system for which the customer furnishes a Navion airframe and Temco convert it to the full Riley '55 standard. Under an agreement concluded this year, the Temco-converted Navion is marketed by the Riley Twin Aircraft Sales Corporation; hence the name.

Conversion was originally suggested by a Los Angeles businessman in 1951. Riley took up the idea, converted a Navion, and obtained a C. of A. The actual conversion work was then delegated to Temco, who redesigned it in August 1953, incorporating 150-h.p. Lycomings. The Riley '55 is the new model of this aircraft. If the engines become available in time, the '55 is to be powered with newly developed 170 h.p. Lycoming 0340s, which will give it a top speed of 180 m.p.h. and allow an increase of gross weight to 3,600 lb. The fuel system is improved, and the addition of wing tanks will allow a range of up to 1,200 miles. In view of the longer endurance the front seats have been redesigned for greater comfort. The instrument panel, almost inevitably for a new model, has also been redesigned. Take-off and landing distance in standard atmosphere over 50ft obstacles are respectively 1,150ft and 1,050ft. Rate of climb is 1,400 ft/min and range on internal tanks at 70 per cent power 900 miles. Fuel consumption is 8-10 gal/hr/engine, and the single engine ceiling is 6,000-8,000ft.

One of the latest producers of light twins in the U.S.A. is Piper Aircraft Corp., whose factory is at Lock Haven, Pennsylvania. Pipers have, of course, built a long series of successful light aircraft of the Cub type, leading up to the Tri-Pacer and the Cruiser series. Their venture in the light-twin field is called the Apache, and it is the lightest and most compact of all the twins here described.

Incidentally, the company recently held a convention of their own, attended by over 200 distributors, at which the work of the company was reviewed. From a series of customer surveys, carried out in the last four years, they have been able to draw some interesting conclusions; for instance, that the percentage of buyers who had never owned Pipers before is steadily increasing and that, whereas in 1951 90 per cent of Piper aircraft sold were used for business purposes, in 1954 the figure is 97 per cent. Each owner flies an average 320 hours per year. The block-to-block speed of the aircraft in service has increased from 114.9 to 119 m.p.h., while fuel consumption in gallons per hour has decreased from 8.9 to 8.1. The company have even established that the average r.p.m. used by their customers has decreased from 2,410 to 2,375.

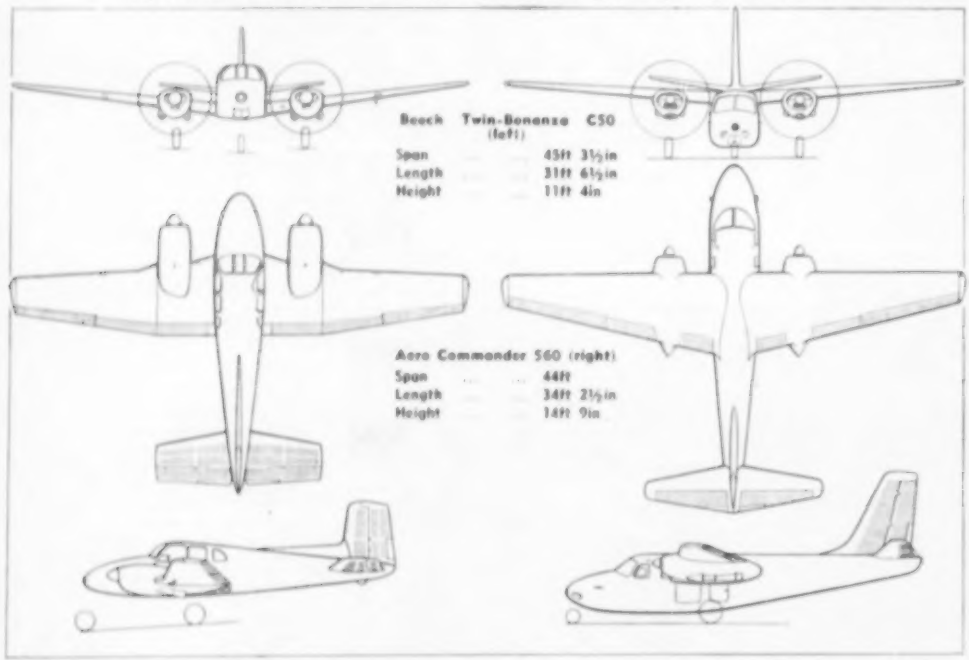
The most significant figures, however, are those concerned with navigation aids and blind-flying instruments. For instance, in 1951, 46 per cent of Piper aircraft owners used standard instrument-panels, and only 8 per cent full blind-flying panels. In 1954, only 14 per cent retained standard panels, 74 per cent ordering full panels. Similarly, radio navigation equipment of the compound "omni" type was fitted by only 17 per cent in 1951, and is now used by 85 per cent. On the other hand, use of A.D.F. has remained constant at approximately 8.3 per cent.

From this can be gained some idea of the increasingly efficient use of business aircraft. The navigation-aid coverage is there; the airborne equipment is available in quantity at prices owners are prepared to pay; and the installation of both this equipment and full blind-flying panels shows that more and more of these light aircraft are being used, airliner-fashion, for journeys in I.F.R. conditions which were previously the prerogative of the fully equipped scheduled airliner.

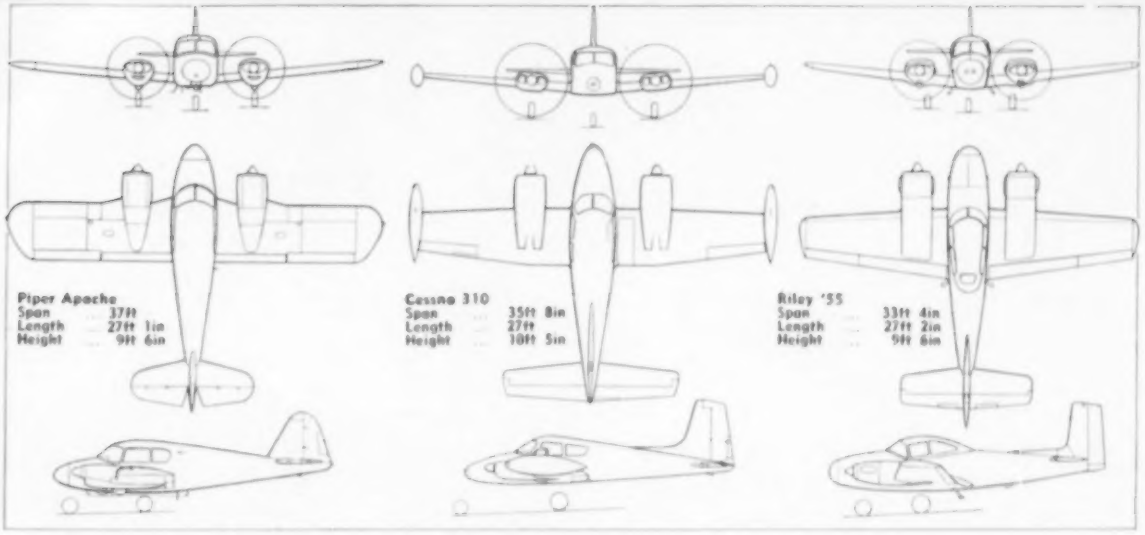
Further surveys have shown that, of the types of people using Piper aircraft for business purposes in 1954, 18.2 per cent were farmers or ranchers, 27.5 per cent manufacturers, 12.2 per cent construction companies, 9.2 per cent physicians, 15.8 per cent wholesalers and distributors, and 6.2 per cent engineers and architects (the remainder are classed as "miscellaneous"). These proportions fluctuate slightly from year to year but remain substantially constant. To support their figures, Pipers announced at the convention that they had a backlog of orders—for Apaches, Tri-Pacers, Super Cubs and PA-18-A agricultural machines—worth $6 million, with firm deposits on hand.

The Piper Apache was described in *Flight* on May 7th last year. It has a cruising speed of 160 m.p.h., an all-up weight of 3,500 lb and is powered by two Lycoming 0-320 engines with Hartzell constant-speed, fully feathering, two-bladed airscrews. It seats four and can, of course, be equipped for night and instrument flying. More than 100 have been delivered since production began last May.

Pipers found that it was cheaper to fly their aircraft to foreign customers than to crate them and ship them, and the most remarkable venture in this respect has been Max Conrad's delivery flight of an Apache direct from New York to Paris last November. The aircraft was destined as a sales representative's demonstrator for the European area. It was a standard airframe with its two 36-gallon wing tanks supplemented by three tanks in the cabin, bringing the total fuel load up to 360 gallons. Max Conrad also installed his own system for adding engine oil in flight. Endurance was reckoned at 25 to 26 hours. Radio equipment consisted of the standard



The largest of the light twins approximately to scale with each other and with those on the opposite page.



The three smaller twins approximately to scale. The sharply kinked leading edges of the Apache's wings are noteworthy.

production model's Narco Omnigator with I.L.S. localizer and eight-channel transmitter, Narco Simplexer 12-channel V.H.F. transceiver, and Lear A.D.F. 12. The only non-standard equipment was a Sunny South M.F. transmitter.

Conrad wore a U.S.A.F. exposure suit and Mae West; and carried with him an inflatable life-raft and a suitcase of normal clothing. Provisions consisted of a box of biscuits, two bottles of Coca-Cola and a fresh grapefruit. The Apache is reported to have reached Paris—after 22 hr 23 min in the air—with 70 gallons of fuel remaining in the tanks. Calculations showed that for the total distance, which is officially 3,625 miles, the average speed was 161 m.p.h., and the average fuel consumption 12.88 gal/hr. At take-off from New York (Idlewild) the Apache weighed 5,000 lb—1,500 lb overload—and the take-off was measured as 2,500ft in a 6-8 m.p.h. cross-wind. This flight alone gives some measure of the capabilities of the Apache—and at least one other of the light twins here described has put up similar performances.

Among them is the Aero Commander, made by Aero Design and Engineering Company, Bethany, Oklahoma. One of these aircraft actually flew non-stop from Oklahoma City to Washington, D.C., over 1,100 miles, with one if its airscrews removed. Moreover, normal cruising power was used and the "live" engine did not suffer unduly. The Aero Commander has also flown over the 19,000ft Mount Popocatepetl in Mexico and, utilizing its normal range of 1,050 miles, it has made delivery flights all over the world, one in particular from Oklahoma City eastwards to Tokyo.

The latest Aero Commander, the model 560, has swept vertical tail surfaces, to compensate for three- instead of two-bladed airscrews and more powerful engines, but the allure of a swept surface is well exploited as a sales attraction. In its standard production form it has two individual seats in front and a three-place bench seat in the rear of the cabin. The space between them is sufficient for the addition of a third row of two seats, these being supplied at extra cost. Various arrangements of ice-boxes and cocktail cabinets can also be located here. A full-length bunk can be made up with collapsible backrests, or the seating so arranged that the passengers can sit round a table. Conversely, all seating can be removed to allow the carriage of freight.

Bearing some resemblance to the Navion, the Riley '55 twin is in fact a direct conversion by Temco.

The standard instrument layout provides for full blind-flying panel and engine instruments, and basic radio communications equipment, but "custom" arrangements of I.L.S., V.O.R., D.M.E. and omni-navigation aids can easily be added, and usually are.

Its Lycoming GO-480-B six-cylinder geared 270-h.p. engines make the Aero Commander one of the largest of all the light twins. At a maximum gross weight of 6,000 lb, it takes off over a 50ft obstacle in 1,100ft, and climbs at 1,400 ft/min on two engines, or with one airscrew feathered at 340 ft/min. Single-engined ceiling is 9,800ft. Cruising speed at 70 per cent rated power at 10,000ft is 197 m.p.h., stalling speed 59 m.p.h. and landing distance over a 50ft obstacle 1,050ft. The lowest stalling speed at 75 per cent rated power, and with 40 deg flap, is 45 m.p.h. at full load. Maximum range with the full 145 gallons usable fuel load is 1,050 miles, with 30 min reserve. All these figures are for the maximum a.u.w.; in the optimum configuration, at an all-up weight of 5,500 lb, performance all round is improved. The Aero Commander is one of the most popular of the light twin executive aircraft on the market and is used by a large number of companies on the American continent and elsewhere.

Probably the most ambitious of the five light twins, and claimed to be the fastest and farthest-flying, is the latest Beech Twin-Bonanza Model C50. It is, in fact, in very much the same speed, weight and range bracket as the Aero Commander. Its maximum range with no reserve, at 10,000ft, is 1,100 miles, similar to that for the Aero Commander with 30 minutes' reserve. Maximum all-up weight is 6,000 lb and cruising speed at 66 per cent power is 200 m.p.h. at 10,000ft. Other figures are very similar to those for the Aero Commander; service ceiling 20,000ft on both engines and 8,500ft single engined, take-off over 50ft obstacle 1,260ft, and landing distance over a similar obstacle 1,375ft. In its standard layout it is a six-seater.

Last year's Twin-Bonanza,* which was in production from January to October—99 were built—had 260 h.p. Lycomings, whereas the C50 has 15 h.p. more each side. Among detail improvements is a more effective and simpler airscrew control, and redesigned cabin heating whereby the blower and automatic control system can also operate when the 50,000 B.Th.U. heating unit is switched off. Exterior finish is offered in 17 different colours, and the interior incorporates "luxurious new fabrics and genuine leather trim." Inevitably, the instrument panel has been redesigned, and radio navigation equipment is now placed within easy reach of the pilot. Optional extras include an airscrew anti-icing system, a rotating navigation light atop the cabin, a nose-mounted taxying light, an evaporative air conditioner and an engine pre-heating system for cold-weather operation.

In their brochures on the Twin-Bonanza, Beech Aircraft make a particular point of safety features. They state, for instance, that the low-wing layout permits 65 per cent of the weight to be located below and forward of the passengers. Shoulder harness is provided as standard equipment and the airframe has been stressed to 8 g maximum load—i.e., considerably higher than the 5.7 g required by the C.A.A. for this type of aircraft. It is, in fact, a very tough aircraft well suited for rough work.

The latest arrival in the field is the Cessna 310, which can boast many distinctive design features. A low-wing five-seat monoplane with single fin and rudder, it is powered by two

**Subject of an "In the Air" report by the Editor in our December 31st, 1954, issue.*

The new Cessna 310, in characteristic American paint finish, is probably the cleanest of all the twins.

The biggest of the group is the Beech B50 Twin-Bonanza, here seen over England while being tried by the Editor of "Flight."

"Flight" photograph

TWINS MEAN BUSINESS . . .

Continental O-470-B engines giving 240 h.p. each at 2,600 r.p.m. The main undercarriage retracts inwards into the wing centre section and all fuel, normally carried here, is accommodated in permanently attached wing-tip tanks; this means that the engine nacelles do not have to house wheels and can be extremely small, giving minimum drag, and that the efficiency of the wing over its whole span is maintained at the highest level, partly because the tip-mounted fuel tanks provide "end-plate" effect. The positioning of the fuel load also constitutes an obvious safety factor. The nosewheel, which retracts rearwards, can carry an optional swivelling taxying light, is steerable through 15 deg either side and castors freely up to 55 deg. The turning radius on the ground is said to be little more than the track of the main undercarriage. The engine cowlings are accessible at waist-height on the ground and, though so small, are said to provide ample space for the addition of optional ancillaries. No cooling gills are required, since the exhausts are led through augmenter tubes which entrain cooling air and provide some extra thrust. This system is also used in several of the other light twins.

All these features have contributed to a cruising speed of 205 m.p.h. and a maximum speed of 220 m.p.h. Span, length and height of the aircraft are respectively 36ft, 27ft and 10ft 5in; empty weight is 2,850 lb, fuel capacity 100 U.S. gallons, and oil capacity 6 U.S. gallons. The list price is $49,950 (£17,900) for the standard aircraft, which includes full blind-flying instrumentation, a 20,000 B.Th.U. thermostatically controlled cabin heater, windshield de-misters, two cigar-lighters, four ashtrays, one red instrument light and two ultra-violet lights, one map-reading light, a baggage compartment light, adjustable reclining seats, cabin radio loudspeaker, a gyro test valve, four ventilators, a coat-hanger, and a clear-vision panel, to name only a few items. Other standard equipment includes electric engine primers, electric fuel-boost pumps, and engine-driven fuel and vacuum pumps, two generators, electrically operated flaps, electrically operated undercarriage (with independent mechanical stand-by), hydraulic toe-operated brakes, parking brake and a landing light in the port wing. Considering the price of the aireraft this equipment is elaborate, but no mention is made of radios. Comprehensive radio equipment of the type usually fitted in executive aircraft is liable to add anything up to $20,000 (£7,150) to the first cost. Even these additions, however, would not bring the Cessna 310 into the Twin-Bonanza's price bracket, where additional radio equipment will cause an equal increase in the basic price.

All-up weights for the 310 vary between 4,000 and 4,600 lb, and the figures that follow are for the representative 4,300 lb a.u.w. which allows for four passengers, full fuel load, and 125 lb of baggage and/or optional equipment. In this configuration, sea-level top speed is 220 m.p.h. and cruising speed at 70 per cent power at 8,000ft, 205 m.p.h.: maximum sea level rate of climb is 1,850 ft/min, and single-engine rate of climb 470 ft/min, increasing by 425 ft/min for every 30 min airborne. Single-engine service ceiling is 9,300ft. Incidentally, wing loading is 24.6 lb/sq ft (typical of the light twins) and power loading 8.9 lb/h.p. Twin-engine service ceiling is 22,000ft and maximum range on internal tankage, at 50 per cent power at 10,000ft, is 1,000 miles. As on most aircraft of this type, the airscrews are metal two-bladed, constant-speed, fully feathering and fitted with spinners. Hartzell is the principal supplier of these airscrews.

The instrument panel is neatly arranged, leaving adequate space for the installation of radio and navigation equipment. Engine instruments are grouped to starboard and all engine and trim controls are located on the central control pedestal; there is provision for dual control.

Following car-industry practice, the light twin manufacturers annually bring out a "new and improved" model, whose basic features inevitably include more engine power, higher cruising speeds and better general performance. Reading between the lines, it is evident that many of the selling-points are, in fact, normal rectifications of minor shortcomings in the original design. Each type, nevertheless, is unquestionably developed to provide better performance, more comfort and better operational characteristics, particularly for all-weather flying and radio navigation.

As engine power is progressively increased the twins encroach more and more on the domain of the larger and not over-economical "custom" conversions, while these in their turn will sooner or later have to be replaced. Some idea of what the replacements will be can already be gained from such projects as the Cessna 620. This is a low-wing monoplane with tricycle undercarriage and seating for eight to ten. It will be powered by four Continental GSO526 six-cylinder geared and supercharged 320 h.p. engines, which will confer a cruising speed of 250 m.p.h., and there will be cabin pressurization. The first prototype of this strictly "corporate" or executive aircraft is due to fly early this year. Going a step further still, one might mention Martin's proposed executive version of the licence-built B-57 Canberra, some details of which appeared in *Flight* on October 15th. Described by the company as a "combat personnel transport," it could seat up to 12 passengers in a pressurized cabin and, as indicated at the time, may well find a number of buyers amongst the larger commercial concerns.

American experience has shown that, in order to provide the type of utilization which would be demanded of it, a successful executive aircraft must be equipped as fully as an airliner. Though a market for such aircraft must exist in Europe, few have so far found homes this side of the Atlantic. The type of equipment which could fill the bill for Europe would be, for example, Decca Navigator, V.H.F. R/T., I.L.S., and radio compass. Equivalent American equipment has been reduced in both size and weight to a point where it can well be accommodated in small aircraft. The requirements basically are for a 4-6 seater, with baggage space, full night and I.F.R. equipment, and preferably twin-engined with real single-engined performance, a cruising speed approaching 200 m.p.h. and a range of up to 1,000 miles. Comfort and reliability would, as always, be essential. Though the American light twins would be useful in Europe, their importation on any scale is difficult mainly because of their high cost; but even this, for many business concerns, would not be excessive in view of the undoubted advantages to be gained from ownership.

C.M.L.

GERMAN SAILPLANE DESIGNS

DETAILS of existing German and Austrian designs of sailplanes and gliders are given in *Deutsche Segelflugzeuge*, recently published at DM5 by Aero-Verlag Hubert Zuerl, Hermann-Lingg-Strasse 9, München 15. Three-view drawings and a short description are given for each of the 43 types listed, many of which are illustrated in addition by photographs. Among the machines described are the HKS-1, the Zugvogel, the Horten Ho-15c Urubu and Ho-33, and the auxiliary-powered Fibo-2a.

CIVIL AVIATION

A.N.A. INTEREST IN THE HERALD

SOME views on DC-3 replacements were expressed recently by Capt. I. N. Holyman, managing director of A.N.A., on his return to Australia after a four-month tour of Europe and the United States. Few manufacturers, he said, showed a real appreciation of the need for a composite passenger/freighter aircraft. The movable bulkhead, he said, was one of the greatest single factors in ensuring sound operating economy.

Capt. Holyman expressed interest in the Handley Page Herald, which he described as "a definite attempt to build a rugged type of aircraft which would go anywhere a DC-3 could go." It had easy access for the loading and unloading of both freight and passengers, and offered a speed of better than 200 m.p.h. over distances of from 300 to 500 miles.

A.N.A., said Capt. Holyman, now derived 30 per cent of their revenue from freight, and 62 per cent of that freight was carried on passenger aircraft. The company was today operating DC-4s as mixed passenger/freighters—between Sydney and Tasmania direct with accommodation for 24 passengers and 10,000 lb of freight, and, in the winter months, from Melbourne to Perth with 36 passengers and 6,000 lb of freight. In February and March the airline expected to take delivery of two DC-6Bs; this type could carry a typical load of 58 passengers and 8,000 lb of freight, and could operate stage lengths of 400 to 2,500 miles. For the routes now operated by DC-3s, Australian conditions called for a composite aircraft capable of carrying 24 passengers and 5,000 lb of freight.

PANAM'S ATLANTIC FREIGHT PLANS

LAST week Pan American World Airways issued a statement expressing their intention of operating daily all-freight services across the North Atlantic before the end of this year. The airline added that it hoped that major cargo tariff reductions would become effective by spring. Such a step depends on reconciliation of differing views among the I.A.T.A. carriers.

Pending the introduction of lower rates, Pan American are withholding part of the capacity of their long-range freighting fleet of three DC-6As. At present these aircraft are operating two return services weekly between Europe and the United States.

The airline's president, Mr. Juan Trippe, has said that PanAm are actively studying "the large, fast turboprop cargo aircraft now being designed to meet the requirements of National Defence," which, when they become available over the next few years, would provide still better and cheaper cargo services to shippers. This has been interpreted as a reference to the promising Lockheed C-130 Hercules.

BOEING 707 PROGRESS

A COMPANY progress report on the Boeing 707 states that the third phase of its flight trials is now due to begin. To date, this jet transport prototype has flown for 92 hr 30 min and, Boeing claim, has achieved higher altitudes than any other transport. Precise figures are not quoted but the 707 is said to have cruised "substantially higher and at greater speeds" than was earlier reported (earlier statements have mentioned 42,000ft and 550 m.p.h.). The cabin of the 707 was pressurized for all but two hours of its total flying time.

On completion of the second phase of trials the aircraft was laid up for minor modifications based on test results, for instrumentation for the third set of trials, and for 100-hour inspection of the four Pratt and Whitney JT-3 turbojets. The engines have been stripped down, incidentally, without being removed from their pod mountings.

Flight tests have been based on Boeing Field, where the 10,000ft main runway was under repair for two months. During this period the 707 operated from a 5,800ft taxiway parallel to the main runway; on most occasions, Boeing report, the aircraft was observed to leave the ground after using less than half the available run.

The company has now begun production of "an initial quantity" of military versions of the 707 for the U.S.A.F.—KC-135 tanker/transports.

AIR-FERRY PLANS FOR 1955

DETAILS of Silver City Airways' 1955 programme were announced on January 5th by Mr. W. G. Franklin, the airline's commercial manager. The main features of the programme are the introduction of new services and further fare reductions—the eighth in seven years.

The new services are on the Southampton-Deauville route, which will be flown daily from April 6th and twice daily from May 25th until October 3rd, and between Birmingham and Le Touquet, which will be operated daily between June 17th and September 19th. Flying times for the two routes are 50 min and 1 hr 25 min respectively.

The company will no longer operate short-range services from Lympne, but from the new Ferryfield Airport at Lydd there will be increased frequency of services to Le Touquet, Calais and Ostend. There will also be a daily service between Gatwick and Le Touquet from May 21st to October 3rd and more frequent flights between Southampton and Cherbourg from April 1st to October 31st.

The busiest route will be that between Ferryfield and Le Touquet; from June 17th to September 19th services will operate at intervals of as little as 10 minutes throughout the day from 6.40 a.m. to 10 p.m. This will be the first year in which the air ferry has operated in darkness. To accommodate travellers making use of the early-morning or late-night flights it is intended to open a "motel" at Ferryfield in the spring.

This year's fare cuts are designed not only to attract extra traffic, but to spread the traffic as evenly as possible over the summer season. As in 1954, reduced rates will be charged for flights made on Tuesdays, Wednesdays and Thursdays. In addition, vehicle owners returning to the United Kingdom at week-ends between April 1st and July 31st will be charged lower fares, and similar one-way off-peak concessions will apply to flights leaving England on week-ends between September 9th and October 31st.

Examples of 1955 single fares on three routes are shown below. Car dimensions refer to overall length, and the fares in parentheses are off-peak.

	Lydd-Le Touquet	*Lydd-Ostend*	*Birmingham-Le Touquet*
Cars (up to 12ft 6in) ..	£7 (£6)	£11 10s (£10 5s)	£18 (£16)
Cars (12ft 6in to 13ft 6in)	£10 (£9)	£14 (£12 10s)	£21 (£19)
Motor cycles (over 250 c.c.)	£2 5s (£2)	£3 10s (£3)	£5 10s (£5)
Pedal cycles	2s 6d	5s	5s
Passengers	£2 10s	£3 17s 6d	£8

Full details of fares and frequencies are found in the latest Silver City Airways timetable, which also contains maps, photographs and articles describing the history and operation of the air ferry. It also includes a quotation, from Lucretius, which will be appreciated by cross-Channel travellers: *"Sweet it is, when on the great sea the winds are buffeting the waters . . . to perceive from what misfortune you yourself are free."*

AIRLINE ACCIDENTS IN 1954

AS shown by the I.C.A.O. and I.A.T.A. traffic statistics reproduced in last week's issue of *Flight*, 1954 was a year of solid achievement by the scheduled airlines of the world. For the first time in history the number of passengers who crossed oceans by air was greater than the number who crossed by ship. On the North Atlantic route alone the airlines offered an air connection at the rate of one every half hour, day and night, throughout the year. Over the entire global network, passengers travelled on scheduled flights at a rate of well over one million weekly.

The growing status of commercial aviation was reflected in the increased public attention devoted in 1954 to the airlines' affairs—their finances, their equipment, their accidents. Inevitably, accidents received the largest share of publicity—particularly the two involving B.O.A.C. Comets. By an extreme coincidence of misfortunes, this airline also lost two of its piston-engined fleet during the same period.

The impression left in the minds of the public by widespread reporting of airline accidents, particularly in Britain, may well be that 1954 was "a bad year" from this viewpoint. Such an impression would, in our view, be false: on a global basis, the incidence of accidents in 1954 certainly shows no upward trend relative to that of previous years. That trend, incidentally, is an encouraging one; all available figures show a continuous year-by-year improvement throughout the post-war period.

According to our own provisional calculations, fatal accidents to scheduled passenger flights occurred at an average rate of once in 15 days in 1954; there were 24 accidents in which a total of 478 passengers and crew lost their lives. During that same twelve-month the airlines operated more than 180,000 flights daily and safely transported more than 58m passengers.

Twelve months is too short a period from which to deduce firm trends in causes and circumstances of accidents. With this provision in mind, it may be noted that most of the 1954 accidents (17 out of 24) could be described as occurring in flight, and in the majority of these cases the most frequent apparent cause was crew error—usually in the form of faulty navigation. These 17 accidents resulted in 321 deaths. Five accidents occurred in the landing phase and resulted in 95 deaths, and there were two take-off accidents (which term is taken to include the initial-climb phase), involving 58 fatalities.

The 24 accidents involved 10 types of aircraft, namely Comet

Los Angeles provides a crowded background to this study of a T.C.A. Super Constellation. Below the aircraft is the "superhighway" which is intended to afford fast, uninterrupted travel through the city.

U.S. AIRLINES CARRY 34 MILLION

SCHEDULED airlines of the United States carried nearly 34.7m passengers last year, according to figures issued by the C.A.A. This represents 60 per cent of the total number of passengers on all scheduled services outside Russia and China. The U.S. domestic trunk lines, which carried some 28m, reported total earnings of £350m, an increase of 9.8 per cent over the 1953 figure.

PAKISTAN EXPRESS

FEBRUARY 1st will see the inauguration of Pakistan International Airlines' weekly Super Constellation service between Karachi and London. Scheduled flying time for the new service is 17½ hr, making it the fastest link between the two cities. The Super Constellations will stop only once for refuelling—at Cairo—on the 4,000-mile route. The aircraft will be flown by British and Australian pilots. Pakistani crews are under training for the airline. A proving flight from Karachi was due at London Airport yesterday; among those expected to be aboard was Mr. M. F. McGregor, the Canadian general manager of P.I.A.

B.E.A. DISPUTE: THE LAST WORD?

A STATEMENT issued jointly by B.E.A. and the trades union side of the National Joint Council explains that, contrary to initial reports, the Corporation is not at this stage withdrawing the document which the 306 recently dismissed employees were required to sign on re-engagement. The document drew attention to the need to abide by agreed methods of negotiating labour disputes. It will later be replaced by a new document drawn up jointly by B.E.A. and the Joint Council. Mr. J. Peters, the shop steward who was the central figure in the dispute involving the dismissals, has lost three appeals against his own dismissal.

INDIA-U.S. AVIATION DISCUSSIONS

INDIA and America have resumed negotiations on the subject of a bilateral air service agreement. The previous agreement, which was due to expire on January 14th, was regarded in India as detrimental to the national airline in that it allowed American companies practically unrestricted traffic rights between Europe and India. The new agreement is expected to contain a clause permitting India to restrict American traffic rights.

Earlier it had been reported that the United States Department of Commerce was withholding export licences for three Super Constellations ordered for Air-India International on the grounds that they might be used on services to Communist China.

On January 6th, however, Mr. Dulles, U.S. Secretary of State, announced the approval of an export licence for the first of the three Super Constellations. Licences for the two others would be approved, he said, when the aircraft were ready for delivery in February and March. There was nothing in the sales agreement, he added, to prevent the use of the aircraft for flights to China.

Shown about to leave D.H. Canada's plant at Ontario is a Beaver ordered for Aerovias Rojas of Tutila, Mexico. Capt. Murillo, its Mexican ferry pilot, is being wished Godspeed by S. Prado, resident consul for Mexico, and Mr. Dickens, the makers' sales director.

CIVIL AVIATION . . .

(2), Constellation (2), Convair 240 (2), DC-3 (11), DC-4 (1), DC-6 (1), DC-6B (2), North Star (1), Stratocruiser (1) and Super Constellation (1). The relatively high proportion of DC-3 accidents is attributable to the fact that this veteran type is still operated in greater numbers than any other.

According to our calculations, the number of scheduled flights made in 1954 was nearly 2,200,000. On this basis, the ratio of accidents involving fatalities to safely completed flights was about 1:90,000. This estimate is approximate, but it is probably as realistic as any other rule-of-thumb method of indicating the passenger's risk of being involved in a fatal accident on boarding a scheduled flight selected at random in 1954.

The yardstick most frequently used to express progress in airline safety is "passenger fatalities per 100 million passenger-miles." This is quite useless as a means of assuring the man-in-the-street that flying is "safe." It does, however, enable the incidence of fatal casualties to be plotted and compared over a period of years. The passenger-fatalities/100m-passenger-miles index for I.A.T.A. carriers dropped from 3.28 in 1948 to 1.41 in 1952.

Using this index as a basis of comparison, it can be shown that U.S. domestic airlines have a consistently better safety record than European regional services, and that the safety record for Europe is better than for the rest of the world, North America excluded. These conclusions are drawn from statistics covering a period of several years, and are not necessarily true for any given year; in 1954, for example, intra-European airline services probably achieved a better safety record (on the basis of deaths per 100m passenger-miles) than the American domestic carriers.

Detailed analysis of accident statistics is a task best left to the professional statistician. Comparisons between aircraft and other methods of transport form a particularly complex field, in which even statisticians fear to tread. On a passenger-deaths/passenger-miles basis it will normally be found that railways have a much better safety record than airlines, and that airlines in their turn have a better record than road transport, if private cars are included.

This is only one basis of comparison, however, and it gives a very incomplete picture. It takes no account of the fact that non-fatal injuries are many times more frequent on rail and road than in air accidents; that road accidents kill thousands of people other than passengers; and that the average passenger-mileages of trains, aircraft and cars vary enormously.

The risk taken by the individual passenger by air, rail or road must depend on the number of occasions on which he exposes himself to the possibility of an accident. The "exposure" factor, so far as air travel is concerned, implies a relationship between the number of flights made and the possibility of accidental death *in a given period*. Nevertheless, it may be noted that an identical risk of being involved in an accident is taken by all the passengers on any one flight, regardless of the number of other flights each has made individually.

One inference may reasonably be drawn from airline accident statistics: the degree of risk taken seems barely sufficient to justify the qualms felt by so many air travellers—knowledgeable and otherwise. Psychologists might be able to explain this apprehension, which should by now have almost disappeared from so commonplace and firmly established a form of transport.

FROM me— TO you...

Would-be customers (said the Managing Director) send us sharp complaints that they don't find my Little Horses sitting on shelves in shops. The Shopkeepers send me similar statements.

Sentimental old ass that I am, my heart bleeds for both customers and shopkeepers. It bleeds a bit for me too, since I am well aware that our direct-selling policy leads to direct losses of sales in some cases. But, (said the Managing Director thumping his chest and wiping his eye) there are finer things in life than mere selling. There is the joy of knowing the customer personally, of understanding his needs and being sure that the right Little Horse is meeting them. There is the deep satisfac . . . ***(At this point the Managing Director burst into loud sobs, choked heavily and the audience escaped).***

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CANADAIR LIMITED
c/o Canadian Dept. of Labour,
61 GREEN STREET, LONDON, W.1

Interviews will be arranged during January and February, 1955

CIVIL AVIATION . . .

BREVITIES

DURING 1954, their first full calendar year of service with B.E.A., Viscounts carried 335,000 passengers between 27 cities in 16 countries. It is also recorded that last year, for the first time, B.E.A. carried more than half the passengers flying between the United Kingdom and the Continent.

* * *

An Aquila Airways crew, commanded by Capt. D. Evans and accompanied by Mr. S. Seymour, Aquila's chief engineer, left Blackbushe last week for New Zealand, where they will take delivery of the first of three Solents bought from Tasman Empire Airways. The Blackbushe-Singapore stage of their journey was being made in a Hermes operated by Britavia, Ltd.

* * *

Eagle Airways announce conditional M.T.C.A. approval to operate a scheduled service between London and Innsbruck during the period June to October inclusive. The airline will operate up to four return flights weekly, providing the only direct link on this route. Subject to approval, fares will be approximately £20 single and £35 return.

* * *

Delivery is being made this month of the last of four complete Cossor Type 53 radio station installations ordered by the ruler of Kuwait—Sheikh Abdullah el Mulbarak—for desert communications. The Type 53 station is a general purpose medium-powered communications equipment operating as either a static or a mobile unit. Remote control is provided and C.W., M.C.W. and R/T. transmissions are possible.

* * *

In preparation for the introduction of all-Stratocruiser service over the North Atlantic later this year, B.O.A.C. are running two-week conversion courses for nearly 200 pilots and engineers at Shannon Airport. The aircraft allocated for training is G-AKGK *Canopus*, the aircraft used by H.M. the Queen and Sir Winston Churchill for recent transatlantic flights. On January 3rd *Canopus* ran off the runway at Shannon during a cross-wind landing, but only superficial damage was caused.

* * *

Air-India International are offering increased standards of comfort to first-class passengers on their Super Constellation services. The number of seats in the first-class compartment has been reduced from 31 to 22, the extra space being taken up by a separate, centrally situated lounge; tourist accommodation remains unaltered at 40 seats.

* * *

According to West German radio reports "a four-engined Aeroflot passenger plane" was lost with all aboard while flying between Moscow and Berlin on December 29th. The victims included members of a cultural delegation returning from a visit to Russia. Cypriot and Italian members of a labour delegation were stated to have been among 13 people killed in an accident last month to an aircraft flying from Peking to Moscow.

* * *

Commenting on a recent reference, in an article on the delivery of T.A.A.'s first Viscount, to the "highly satisfactory" performance of the pressurization and air conditioning, Sir George Godfrey and Partners, Ltd., remark that the system was designed by Vickers-Armstrongs and includes Godfrey cabin superchargers and a Godfrey cold-air unit.

CLUB AND GLIDING NEWS

WITHOUT a single training accident in 1954, Lasham's gliding clubs completed 15,457 launches, 1,816 flying hours, and 2,809 cross-country miles during the year. Three British records were established from the site (by Philip Wills, Lorne and Ann Welch and Mrs. Evie Deane-Drummond), at which soaring was found possible on 117 days. Certificates gained by members comprised 76 As, 76 Bs, 16 Cs, 6 "Silver C" legs, 3 "Gold C" legs. The combined membership of the Surrey, Army, Imperial College, Crown Agents and Polish Air Force Association clubs is now over 400; in addition, the site is used by the B.G.A.'s No. 1 Test Group and the Air Section of Winchester College C.C.F. The College cadets, incidentally, will be the first pupils to be taught to glide on the prototype Slingsby T.42.

THE recent return from Jamaica of Paul Blanchard, ex-C.F.I. of Cambridge University Gliding Club and the Surrey Gliding Club, coincided with the publication of his book, *Elementary Gliding*. Intended as a manual for pupil glider-pilots, this useful handbook consists of a printed version of the duplicated notes previously circulated to members of the two clubs. After describing glider construction, basic principles of flight, and the effect of the controls, the author deals in turn with the straight glide, turns, stalling, the winch launch, cable-breaks, circuits and landings, spinning, sideslipping and the use of air brakes. Appendices cover instruments, thermals and gusts, "more about lift and drag" and how to obtain the best performance under various conditions. For once, would-be readers will not be put off by the price: they will need only to forgo the cost of one or two launches. Cartoons and technical sketches by A. R. I. Austin and P. Sullivan respectively add to the readability of the handbook. It is published at 5s by Thermal Equipment Ltd., 17 Hanover Square, London, W.1.

A PRESENTATION fund has been established for Mrs. Alex Orde, until recently Secretary of the British Gliding Association. It is hoped that Mrs. Orde will receive a personal gift and a silver model sailplane, and that the remainder of the money will be used to establish a fund for encouraging young glider pilots. Contributions should be sent to the B.G.A. at Londonderry House, 19 Park Lane, London, W.1, where Mrs. Yvonne Bonham has taken over from Mrs. Orde as secretary. The Association is holding what has become its annual ball on Friday, March 11th, this year, from 8 p.m. to 2 a.m., and the Instructors' Conference and the annual general meeting will take place on the following day.

NATIONAL AIR RACES, 1955

AS briefly recorded last week, the Royal Aero Club has adopted a new plan for this year's National Air Races. The main object is to increase the spectator-appeal this year by making the races accessible to more people, and by concentrating on short, closed circuits, visible during the whole of the race from the base aerodrome. Full details of the arrangements are as follows:—

The Trophies: *S.B.A.C. Challenge Cup*, for aircraft with a maximum sea-level speed of more than 160 m.p.h.; *Air League Challenge Cup*, for Austers, and aircraft (other than Tiger Moths) for aircraft with a maximum sea-level speed of more than 130 m.p.h. and not included in either of the foregoing classes; *Norton-Griffiths Challenge Trophy*, for D.H. Tiger Moths; *Grosvenor Challenge Cup*, for Austers, and aircraft (other than Tiger Moths) with a maximum sea-level speed of not more than 130 m.p.h.

Organization: At each of four separate meetings, five races will be held, one for each of the above classes. There will thus be a total of 20 racing events. Points will be awarded according to places attained both on handicap and on actual speed. The pilot who at the end of the season has gained the most points in the races for one particular trophy will become the winner of that trophy. A separate race will be flown for the King's Cup, by the first 15 pilots placed in the 1955 British Air Racing Championship. Aircraft must not exceed 1,750 kg (3,858 lb).

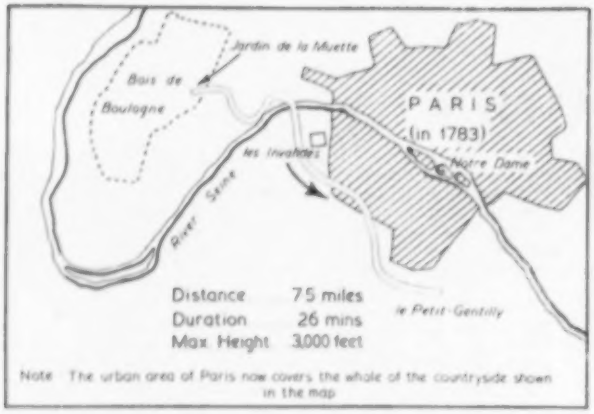
In each of the class races, the number of competitors will be limited to six: pilots may be of any nationality, and they may enter for more than one class.

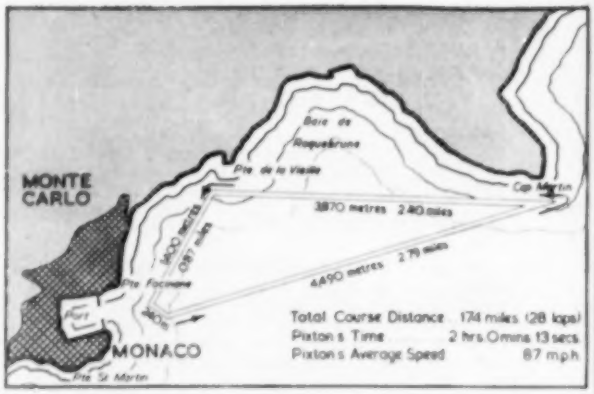
The Meetings: (1) Fairwood Common Aerodrome, Swansea—Saturday, April 30th (in conjunction with the Swansea and District Flying School and Club). (2) Yeadon Aerodrome, Bradford/Leeds—Whit-Saturday, May 28th (in conjunction with the Soldiers', Sailors' and Airmen's Families Association). (3) Bristol Airport, Whitchurch—Saturday, June 11th (in conjunction with the Bristol and Wessex Aeroplane Club). (4) Coventry Civic Aerodrome, Baginton—Saturday, August 20th (in conjunction with Coventry Corporation).

An air display will supplement the races at each meeting; on the fourth occasion, at Baginton, the King's Cup Race will be flown (in addition to the final races) and a new International aerobatic competition will be held.

The Courses: Each of the five class races will be flown over five laps of a six-mile closed circuit. The King's Cup Race, the Royal Aero Club state, will be flown on a handicap basis "over a short closed circuit."

Prize Money: A minimum of £250 will be awarded at each meeting. First, second and third prizes will in each case be £25, £10 and £5 respectively and a £10 prize for the highest speed in each race will also be given. The foreign pilot with the greatest number of points will receive a prize of £25 presented by the Norwegian pilot Capt. Jan Christie.



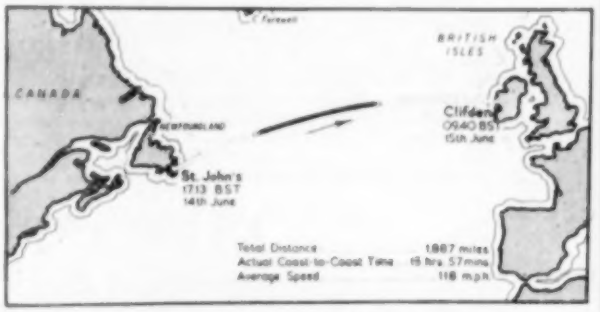


(Left) November 21st, 1783: Man's first air journey—Francois Pilâtre de Rozier and the Marquis d'Arlandes (Montgolfier hot-air balloon). (Right) April 20th, 1914: Schneider Trophy won by Britain—Howard Pixton (Sopwith Tabloid seaplane).

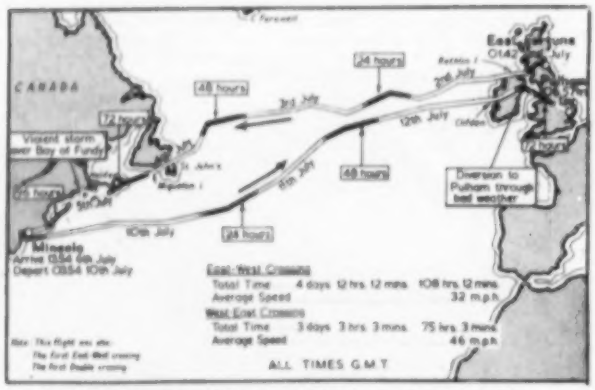
FAMOUS FLIGHTS

—recalled in R.Ae.S. "Young People's" Lecture

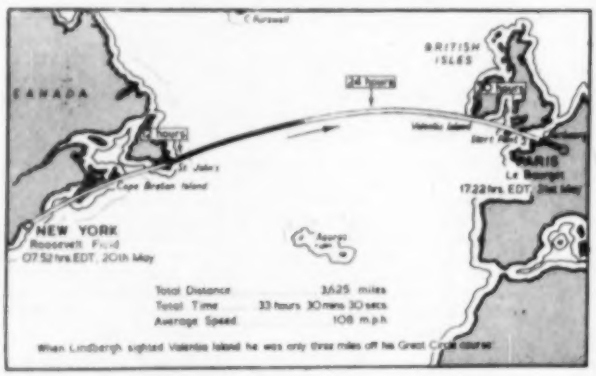
A FEATURE of Mr. Peter Masefield's lecture, *Great Events in Aviation*, given under Royal Aeronautical Society auspices before a youthful audience in London last week, was its illustration by specially prepared track-charts of famous flights. A selection is reproduced here. Historical films were also shown by the lecturer, who traced in informal fashion the major aviation events since the activities of the Montgolfier Brothers in 1783, and afterwards dealt skilfully—with the occasional assistance of Sir Sydney Camm (chairman)—with some forthright questions. Flights described in the lecture, in addition to those shown here, were the first crossing of the English Channel by air (Blanchard and Jeffries, hydrogen balloon, January 7th, 1785); first Channel crossing by aeroplane (Blériot, Blériot XI monoplane, July 25th, 1909); first England-Australia flight by a woman (Amy Johnson, D.H. Gipsy Moth, May 5th-24th, 1930); the winning outright of the Schneider Trophy by Great Britain (Boothman, Supermarine S.6B, September 12th, 1931); and the England - New Zealand race of 1953.



June 14-15th, 1919: First non-stop Atlantic flight—Sir John Alcock and Sir Arthur Whitten-Brown (Vickers Vimy).

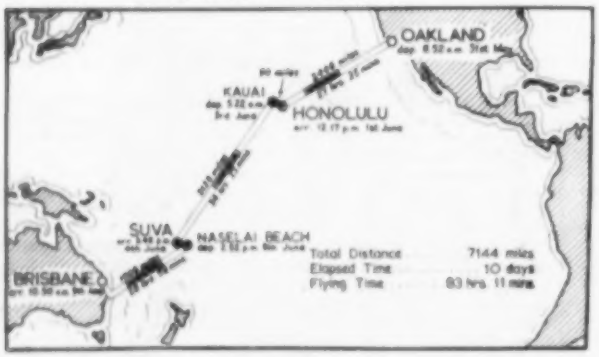

CANADA
24 hours
48 hours
72 hours
96 hours
Vicount storm over Bay of Fundy
Diversion to Pulham through bad weather
Mineola
Arrive 0354 5th July
Depart 0854 10th July
East-West Crossing
Total Time 4 days 12 hrs. 12 mins. 108 hrs. 12 mins.
Average Speed 32 m.p.h.
West-East Crossing
Total Time 3 days 3 hrs. 3 mins. 75 hrs. 3 mins.
Average Speed 46 m.p.h.
ALL TIMES G.M.T.

July 2-6th and 10-13th, 1919: First Atlantic crossing by airship—Maj. George Street with 32 crew (Beardmore rigid airship, R.34).


CANADA
BRITISH ISLES
24 hours
Cape Breton Island
PARIS
Le Bourget
1722 hrs. EDT, 21st May
NEW YORK
Roosevelt Field
0752 hrs. EDT, 20th May
Total Distance 3,625 miles
Total Time 33 hours 30 mins. 30 secs.
Average Speed 108 m.p.h.
When Lindbergh sighted Valentia Island he was only three miles off his Great Circle course

May 20-21st, 1927: First solo Atlantic crossing—Charles Lindbergh (Ryan NYP monoplane).

May 31st-June 9th, 1928: First trans-Pacific flight—Sir Charles Kingsford Smith (Fokker F.VII/3m). (Right) October 20-23rd, 1934: The "MacRobertson" race—winners, C. W. A. Scott and T. Campbell-Black (D.H. 88 Comet).



SERVICE AVIATION

Royal Air Force and Fleet Air Arm News

No. 27 Sqn. Standard Presented

ON Friday last, at Scampton, Lincolnshire, No. 27 Squadron received its Squadron Standard. The reviewing officer was A.V-M. A. E. Borton, C.B., C.M.G., D.S.O., A.F.C., R.A.F. (Retd.), who, in December 1915, became the unit's second commanding officer.

The ceremony took place in the squadron's hangar, which had been suitably decorated for the occasion. The two flights paraded in front of a most effective backcloth, designed and produced by Cpl. Aplin. This had a large representation of the squadron badge, with its green elephant motif, flanked by the badges of Bomber Command and No. 1 Group.

On the dais with the reviewing officer, who was wearing the uniform of the Deputy Lieutenant of the County of Kent, were Air Marshal Sir George H. Mills, A.O.C.-in-C. Bomber Command, A.V-M. J. R. Whitley, A.O.C. No. 1 Group, and G/C. D. J. P. Lee, Scampton Station Commander. S/L. P. W. Helmore, the C.O. of No. 27 Squadron took the parade. No fewer than eight previous commanding officers were present at the presentation.

Organization and drill were near-perfect, and the ceremony attained an almost dramatic intensity as the newly presented Standard was marched in slow time from the piled drums to the squadron, the band of the R.A.F. College, Cranwell, playing the National Anthem.

The battle honours selected to appear on the Squadron Standard are: Western Front 1916-1918; Somme 1916; Ypres 1917; Cambrai 1917; Malaya 1941-1942; Arakan 1942-1944; North Burma 1944; Burma 1944-1945.

At after-dinner speeches during the guest night which followed the ceremony, the company was regaled with stories of early days of the squadron, particularly by G/C. Sidney ("Crasher") Smith, who recalled having to explain five "untidy" aircraft when Major Borton came to take over in 1915.

G/C. Lee, the Station Commander, regretted the loss to No. 27 Squadron of three senior officers recently. (S/L. Sizer to Bomber Command, S/L. Boden to Farnborough and the late C/O., S/L. Chopping who, it is thought, may next be heard of in connection with a Valiant squadron). He wished the unit well in its forthcoming trip with No. 21 Squadron to the Mediterranean for NATO exercises.

New Year Honours

BELOW is continued, from page 31 last week, the list of officers and airmen who are recipients of New Year Honours or awards.

ORDER OF THE BRITISH EMPIRE

Knight Commander: Air Marshal J. P. J. McCauley, R.A.A.F.

Commander: G/C. G. C. Hartnell, R.A.A.F.

Officers: G/C. H. D. Hamilton, R.A.A.F.; G/C. J. L. Waddy, R.A.A.F.; S/L. C. D. M. Kingsford, R.N.Z.A.F.

Members: Act. W/C. L. N. Kroll, R.A.A.F.; S/Ls. J. L. Aron; J. W. Judge; E. S. Odbert, M.B., B.Ch.; D. G. Roberts, M.M., R.A.F. Regt.; and B. C. Johnson. Act. S/Ls. C. Chesterfield, R.A.F.V.R.; L. F. Crawley; G. A. Jeffery. F/Ls. L. J. Anderson; J. A. H. Armstrong; P. T. Brown; J. W. Eastham; A. H. G. Grant; J. Macintyre, R.Aux.A.F.R.; J. S. Millman; E. Minter, A.F.C.; J. W. Mondschein; J. A. O'Connell; T. N. F. Orr; R. W. B. Rainford; D. F. Shallow; B. Smith, D.F.C.; H. J. Smith, D.F.C.; W. W. C. Snipp; J. C. G. Wilson; and R. Wood; J. W. Wylie, R.A.A.F.; and N. A. Spring-Rice, R.N.Z.A.F. F/Off. M. A. Clayden, W.R.A.F. Act. F/L. G. Shaw, R.A.F.V.R. F/O. T. W. Baker. W/Os. F. J. Collis; D. A. Crombie; W. M. Goddard; R. Humphrey; G. H. Meager; W. J. Morris; B. R. Newman; J. T. Norman; W. P. Roberts; J. Rockley; E. S. C. Saunders; W. D. Sinclair; E. J. Tufnail; R. A. E. Underhill; L. Walker; J. Waugh; T. R. Fotheringham, R.A.A.F.; C. H. Perrett, R.N.Z.A.F.; and L. W. Thompson, R.N.Z.A.F.

Air Marshal J. P. J. McCauley, R.A.A.F., appointed K.B.E. in the New Year Honours.

AWARDS

Bar to Air Force Cross: W/C. H. A. C. Bird-Wilson, D.S.O., D.F.C., A.F.C.; S/L. A. D. Burt, A.F.C.; S/L. R. B. Cole, D.F.C., A.F.C.; Act. S/L. R. L. Topp, A.F.C.; F/L. C. I. Blyth, D.F.C., A.F.C.

Air Force Cross: W/C. G. G. Petty, D.S.O., D.F.C.; S/Ls. L. F. Banks, D.F.C.; D. Bower, M.B.E.; S. R. Dixon; K. L. Hughes; D. C. L. Kearns; W. Kent; E. J. Roberts; I. D. Roxburgh, A.F.M.; J. E. Storrar, D.F.C., R.Aux.A.F.; H. M. H. Tudor, D.F.C.; F. P. Walker; J. A. Rowland, R.A.A.F.; C. W. Brackenridge, R.A.A.F.; W. R. Fitter, R.A.A.F.; and Act. S/L. C. F. Fivash, R.A.A.F.

F/Ls. C. Bartlett; S. Bowater, D.F.C.; W. D. D. Davies; J. G. Gould; F. H. W. Harrington; K. Jenkins; P. W. I. Jenner; J. M. McCann; C. R. Palmer; R. M. Raw; G. Richards; S. D. Timms; N. Westby, D.F.C.; T. Wier; D. W. Leckie, R.A.A.F.; and R. A. Mackinder, R.N.Z.A.F.

Air Force Medal: F/Sgt. (now Pilot Officer) P. Clark. F/Sgts. L. Craven; P. C. Crouch; A. Dixon; G. S. Kerr; R. G. Wilding; and W. J. McC. Wilson; Sgts. N. Lawrence; I. N. Moran, R.N.Z.A.F.; J. J. F. Logan; R. W. J. Rhoden; and L. A. Walter. Act. Sgt. A. K. Kidd.

Royal Red Cross (Second Class): S/Off. D. G. Masters, P.M.R.A.F.N.S.; and F/Off. D. V. L. Sharples, P.M.R.A.F.N.S.

Queen's Commendations for Valuable Service in the Air: Act. W/C. E. R. Dutt, A.F.C.; S/Ls. G. J. Beardsall, R.Aux.A.F.R.O.; J. A. Blythe; P. Cassbowry; D. H. Chopping, D.F.C.; R. W. G. Freer; W. J. Potocki, D.F.C.;

"Flight" photograph

A.V-M. A. E. Borton, the reviewing officer, gives the No. 27 Squadron Standard into the care of the Ensign, F/O. A. Chapman.

At the No. 27 Squadron Standard presentation at Scampton, S/L. P. W. Helmore leads his squadron march past in slow time past the dais. (Right) A.V-M. A. E. Borton inspecting No. 2 Flight. "Flight" photographs

SERVICE AVIATION . . .

J. A. Sowrey, D.F.C.; and J. C. Steele. F/Ls P. E. Bairsto; F. W. Bell; D. Chapman; R. Clark; K. M. Hall; W. R. Herbert; A. F. Jenkins; C. H. Lazenby (since deceased); C. C. MacGillivray; R. R. McGowan, A.F.C.; A. D. Piggott, R.A.F.R.O.; C. D. Preece; C. J. G. Short; R. J. Skinner; G. H. Snape, D.F.C.; M. H. Ware; R. Watson; J. D. Espie, R.A.A.F.; J. Whelan; and D. M. Divers. F/O. W. W. Mudry; Lt.-Cdr. R. M. Crosley, D.S.C., R.N. Lt-Col B. E. M. Repton, R.A. M/Plts. R. L. Chantler and Z. Czarnecki. M/Eng. J. M. McCallum, A.F.C. F/Sgts. N. E. Cooke and R. G. Waddell. Sgts. A. B. Dicken (now Pilot Officer); G. G. Griffiths; R. G. Hardy; and B. N. Heathfield.

British Empire Medal (Mil.): F/Sgts. W. M. Clark; R. N. Dickinson; L. Earnshaw (now Act. Warrant Officer); G. A. Eccles; F. Elston; A. E. Goulding; S. H. J. Hammond; R. Harvey; R. T. Jeffrey; R. Langton; A. O. J. Laughton, R.A.A.F.; W. P. McCormack; H. Noden; G. H. Percy; F. J. Sanders; P. Scott; G. W. Tisley; L. E. Watson; W. G. Wise; L. A. Wright; R. J. Martin, R.A.A.F.; W. H. Staniland, R.N.Z.A.F., and J. H. Watts, R.N.Z.A.F. Act. F/Sgt. M. W. Longmuir, W.R.A.F.; Act. F/Sgts. J. Mitchell and E. E. Brailsford; Sen. Tech. J. E. McNeill; Ch. Tech. B. O. Thomas; Ch. Tech. E. M. W. Wingrave, W.R.A.F.; Sgts. O. P. Carr; E. J. Clarke; J. Clayton; S. J. R. Curry; G. Harper; A. Harris; B. M. Hill; A. V. Macoy; R. J. Macrae; D. MacG. Middleton; F. Pendlebury; H. Scattergood; W. J. Smith; M. J. Gorman; W. R. Austin, R.A.A.F.; E. O. Deas, R.A.A.F., and F. W. Morgan, R.A.A.F. Cpls. A. Dodds; T. R. Hiscock and L. Sumner. Cpl. Techs. R. D. Saunders and K. J. Sheppard. Act. Cpl. R. MacF. Macleod. Sen. A/C. A. R. Lewis.

Carrier Heeling Trials

THE new Fleet carrier, H.M.S. *Ark Royal*, is to undergo heeling trials in Gladstone Dock, Liverpool, during the next fortnight. It is intended to impose upon the vessel a list of ten degrees, or possibly even more, in order that Cammell Laird, the builders, can determine the efficiency of all her machinery and equipment in the listing condition. It will then be known how well the ship will function if she acquires a heavy list at any time due to battle damage.

Aircraft Carriers Discussed

AT a dinner held by the Worshipful Company of Coachmakers and Coach Harness Makers, at which Admiral of the Fleet Sir John Cunningham and the Board of Admiralty were guests, the First Lord of the Admiralty, the Rt. Hon. J. P. L. Thomas, M.P., said that it was in the tradition of both the Coachmakers and the Royal Navy to aim at the best and be satisfied with nothing less. The Navy tried to reconcile the traditional forms with the latest improvements but, whereas both aimed to build the smallest and most economical structure fully capable of doing a particular job, there was one case in which size was not being reduced—the aircraft carrier.

Mr. Thomas said there were three compelling reasons for this. Modern aircraft demanded larger platforms from which to operate; small ships could not be made to go as fast so economically as large ones; and the smaller carrier could not accommodate enough aircraft to perform the three functions of its offensive role—reconnaissance, attack and self-protection.

He reminded his listeners that we had in Service at the moment the five newest carriers in the world. The Fleet carrier, he said, could bring the resources of a fully equipped modern airfield to within a few miles of a hostile shore anywhere round the world, and those ships were far less vulnerable to attack by the new bombs than any land target of comparable importance.

As for submarine attacks, means of detection and counter-attack already existed which would make life very hazardous indeed for a hostile submarine, and we had still better things up our sleeve. The big carriers were the striking force of our Fleet and would, he thought, remain so for some considerable time—quite possibly for another generation of ships.

In the remainder of his speech, Mr. Thomas stressed the continuing usefulness of the three *Tiger*-class cruisers which were now being completed, and of the battleship *Vanguard* which, he said, was still one of the most formidable warships in the world.

Half-Yearly Promotions

CONTINUED below, from page 31, is the half-yearly list of Royal Air Force promotions.

Squadron Leader to Wing Commander: M. H. Constable-Maxwell, D.S.O., D.F.C.; J. M. Morgan, D.F.C.; C. G. St. D. Jeffries, D.F.C.; T. H. Baker, D.F.C., D.F.M.; N. S. Petch; D. H. L. Farmer, D.F.C., A.F.C.; T. S. Kitching, D.F.C.; H. R. Rittey; G. J. Gray, D.F.C.; R. R. Mitchell, M.B.E., D.F.C; H. N. Phillips, D.F.C.; M. Paterson, D.F.C.; C. R. Alexander, M.B.E., D.F.M.; D. B. Bretherton, D.F.C.; R. T. Bainbridge, A.F.C.; R. H. Blackmore; J. D. Beresford; R. E. Havercroft, A.F.C.; J. Segar; W. G. K. Gorrie, D.F.C.; J. Rennie; M. C. Raban, A.F.C.; J. A. Brignell, O.B.E., D.F.C.; G. F. Reid, D.F.C.; R. S. Radley, D.F.C., A.F.C.; J. S. Higgins, D.F.C., A.F.C.; J. V. Marshall, D.F.C.; E. R. Dutt, A.F.C.; G. T. Thain, D.F.C.; E. A. Fairhurst, D.F.C.; P. L. Arnott, D.F.C.; R. A. Watts, A.F.C.; A. J. Scott, D.F.M.; R. G. Knott, D.S.O., D.F.C.; N. Williamson, D.F.C.; M. C. Bunting, M.B.E.; G. W. O'N. Fisher, O.B.E., D.F.C.; C. K. Saxelby, D.F.C., A.F.C.; E. W. Wright, D.F.C., D.F.M.; A. Shaw, D.F.C.

W. C. T. Brown; J. Cassell; S. Williams, O.B.E.; F. C. Lowe; G. J. Pean; J. A. R. M. Reid; P. F. Weller; W. J. Bourne, B.Sc., A.M.I.E.E.; W. H. Coast; G. E. Langley; R. H. Whipp; A. W. Skingsley, B.E.M.; A. C. Whitfield, M.B.E.; G. T. Dale; J. W. McCombie, O.B.E.; A. McArthy; R. Storey; A. H. Dormer; G. H. Thomas, M.B.E., A.F.R.Ae.S.; C. W. Kemp; N. L. Letten; J. D. Mallinson, A.F.C.; W. Mathieson; J. Goodman; G. M. Beer; J. G. Bewley; W. G. Welch; W. D. Symes; J. J. Dutton, O.B.E.; E. D. Hills, M.B.E.; B. B. Johnson; D. McD. Jannaway, O.B.E.

H. Knowles; K. W. C. Bindloss; P. A. L. Cooper; H. Quittenden, A.F.C.; A. West, A.F.M.; E. D. Levien, D.S.O., D.F.C.; C. H. Beeton; G. F. Rogers, O.B.E.; N. Welch, O.B.E.; C. J. Myers; C. F. Price; H. H. Wood-Glover, M.B.E.; T. N. N. Brennan, M.B., B.Ch.; D. S. Grant, M.R.C.S., L.R.C.P.; D. M. Keir, M.B., Ch.B., F.R.C.S.(Edin.); G. W. Cloutman, L.D.S.; E. M. Poole, L.D.S.; S. R. Williams, M.A.; R. E. Stephens, B.Sc.

Squadron Officer to Wing Officer, W.R.A.F.: B. B. Parker.

Flight Lieutenant to Squadron Leader: T. W. G. Godfrey, D.F.C.; I. W. Harris, D.F.C.; G. H. W. Glenn, D.F.C.; R. McGugan; E. D. Martin, D.F.M.; G. R. S. McKay, D.F.C.; G. Murphy; P. Edelsten; R. F. Lown, D.F.C.; R. W. Steel; R. H. Smith, D.F.C.; E. S. Hughes, D.F.C.; V. G. S. Casley; G. J. Macrae; F. G. Mackay; C. E. Butterworth; W. E. F. Gray, A.F.C.; J. B. Miller, D.F.C.; N. C. P. Buddin; R. G. Collins, A.F.C.; G. G. Davies, D.S.O.; N. E. Metcalfe; K. Tebbutt, A.F.C.; J. R. Ramsden, A.F.C.; J. A. Heatherill; N. C. Thorne, A.F.C.; D. J. Nicholson; C. R. Winter, D.F.C.; J. F. Pinnington; G. Allan, M.C., A.F.C.; K. J. Derisley, D.F.C.; J. F. Langer; W. L. Baxter; A. J. Owen, D.F.C., D.F.M.; G. W. Johnson, D.F.C.; J. G. Armstrong; E. R. Chalk, A.F.C.; D. M. Turner-Ettlinger; J. Macdonald, D.F.C.; A. P. Norman, D.F.C.; J. A. Cook, D.F.M.; P. Smith, M.B.E.; F. P. Mulkern; N. G. Townsend, D.F.C.; W. N. H. Brawn, D.F.C., A.F.C.; N. W. Heale; V. G. Clarke; C. J. G. Short; N. R. L. Bristow; A. G. Reid; M. Kaye; D. L. Hughes, D.F.C.; R. A. Seymour; R. J. Brain, A.F.C.; C. B. W. Downes; R. H. Crompton; C. B. Urwin, D.F.C., A.F.C.; P. J. Chambers; M. J. Gray, D.F.C.; N. F. Robinson, A.F.C.; E. A. Riseley; H. T. Brown, D.F.C.; J. E. Cockfield; K. Johnson; L. G. Hurrell; P. M.

No. 60 Squadron, R.A.F., at Tengah, Singapore, where they are based. The commanding officer (seated, centre) is S/L. H. D. C. Webbe. Six of the squadron's Vampires flew to Ceylon recently to take part in an air display at Ratmalana.

A Bristol Sycamore helicopter with which the R.A.F. is making operational trials in Kenya. As reported in "Flight" of December 17th, a machine of this type has taken off at 8,430ft, believed to be a record for helicopters of the class. F/O. F. A. Bernard, left is the pilot.

SERVICE AVIATION . . .

Mitchell; J. C. Marmion; E. J. Webb; S. J. Hubbard, D.F.C., A.F.C.; B. J. Spragg, D.F.C.; J. M. Calvey; T. Kennedy, D.F.C.; N. Fletcher; W. J. L. Sheehan, D.F.C.; J. A. Stephen; F. B. Hamilton; J. W. Aldridge; R. H. Arscott; S. Hatton.

H. R. Williams; D. E. King, D.F.C.; W. C. Blair; A. H. Dick; H. J. Scull; E. N. Scott, A.F.M.; T. P. Fargher, D.F.C.; C. Bartlett; C. E. Ness; R. Cox, D.F.C.; S. B. Winn; J. E. Townsend; M. Crosbie; C. W. Clark; R. L. Topp, A.F.C.; J. Langston; R. C. Brown; I. Hutchinson; C. R. Gordon; C. A. Wade; G. H. Tasney, A.F.C; J. R. Larkan; S. T. L. Baker; L. F. Ralls; P. H. Tew, A.F.C.; F. Wright, D.F.C.; C. O. Beck; J. L. Berry; E. G. Holmes; A. Mitchelmore; A. L. McGrath, D.F.C., A.F.C.; J. E. Ryan; F. R. Pusey; A. W. B. Stewart, B.Sc., A.M.I.E.E.; R. Stephens; J. Macfie; W. G. Toogood, B.E.M.; J. Ford, A.F.R.Ae.S.; D. Wilkinson; R. C. G. T. Rogers, A.F.R.Ae.S.; G. W. H. Ware, D.F.M.; R. F. Plucknett; J. R. Jaques; L. W. J. Reeves; L. S. Denyer; D. J. Hughes; C. E. Cockle; J. W. Holmes; A. Contaris, M.B.E., A.F.C.; W. T. Jackson; J. Gillespie, M.B.E.; J. E. Smith; J. Ninian, M.B.E., D.F.C.; W. T. Bussey, M.V.O., B.E.M.; W. Jopling, M.B.E., B.E.M.; C. Bruce; D. A. McF. Walker; W. R. F. Cooney; J. A. Parker, M.B.E.; J. H. Eaton-Shore; R. W. Lowden; A. J. Churchward; J. J. F. Long; F. C. Airey; R. V. Stirling; A. H. G. Grant; J. I. R. Bowring, M.B.E.; D. O. Buxton, A.F.R.Ae.S.; P. W. G. Cordrey, A.F.R.Ae.S.; H. H. Watkinson, A.F.R.Ae.S.; E. W. Lamb, M.V.O.; G. G. Fowler, A.F.R.Ae.S.; S. W. Cornes; S. G. R. White; W. S. Frost; V. S. Hall; S. C. Taylor; A. W. Pawson; H. B. Reynolds; W. E. Satterthwaite; A. N. Byron, A.F.R.Ae.S., D.C.Ae.; D. J. Flood, D.F.C., A.F.C.; J. B. Wellingham, M.A.

S. Foster; G. S. E. Clark; F. H. J. Skeet; F. Binns; H. K. Carrol; E. J. Poole; S. A. White; N. J. King, M.B.E.; J. Brodie; H. A. Tester; J. T. Seeley; L. V. Wallace; W. J. Tuft, M.B.E.; J. E. Gibbs, D.F.C., D.F.M.; H. J. Sadd; E. M. Harrison; J. W. Wood; G. Cubby, M.B.E.; H. J. O'Brien, D.F.C.; N. H. Potts, C. Merrick, M.B.E.; N. Quelch; W. J. B. McDowell; R. J. Kennett, M.B.E.; H. A. Penny; F. T. Russell; E. H. O'Toole; P. R. Worzencraft; A. A. Purdom; D. E. Adamson; M. F. V. Pearson; R. W. Johnstone; P. E. Charlton; P. A. Brewer; A. W. Barnard; G. Rees; D. R. H. Jones; A. Smart, B.E.M.

Flight Officer to Squadron Officer, W.R.A.F.: E. M. Collings; K. M. Parker; K. T. Hatfield; H. Winton; G. D. Bell; M. M. West.

Flying Officer to Flight Lieutenant: R. W. Weisham; C. E. Seppings.

The two A.T.C. cadets who were fortunate enough to be selected to accompany Mr. George Ward, M.P., Under-Secretary of State for Air, on his recent tour of Service units in the Middle East: Cdt. Sgt. D. V. Delap (left) and Cdt. Sgt. H. B. Hall.

Wartime Fighters for Museum

THE Mark I Hawker Hurricane, L.1592, which was exhibited in the Royal Air Force ground display on Horse Guards Parade during Battle of Britain Week last September, and a Mark I Spitfire, R.9444, have been passed by the Air Ministry Air Historical Branch to the Science Museum, South Kensington, on indefinite loan. The aircraft were chosen as early examples of the two main fighter types used in the Battle of Britain. They will go on exhibition when new accommodation for them is completed.

The Hurricane is a veteran of No. 615 (County of Surrey) Squadron, R.Aux.A.F. —"Churchill's Own." When based at Kenley during the Battle of Britain it was shot down and force-landed at Croydon on August 18th, 1940, while defending that airfield. Its wings are fabric-covered, in comparison with those of later marks, which had metal skins. It began its career with No. 56 Sqn on June 3rd, 1938, and when war broke out was with No. 17 Sqn, which received it in July 1939, at Debden, Essex. Except for a brief stay with No. 43 Sqn, from October to November 1939, it remained with No. 17 Sqn until February 1940 when it became part of No. 152 Sqn. In July 1940 it went to No. 615 Sqn at Kenley. After being shot down in August 1940 it was transferred to a Special Duty Flight on October 10th that year and was soon in the air again. From April 1942 it flew non-operationally at No. 5 Pilots' Advanced Flying Unit. That Hurricane's first recorded operational sortie was on January 30th, 1940, when P/O. Harris, of No. 17 Squadron, took it off on a scramble from Martlesham Heath, Suffolk, to intercept unidentified raiders. No contact with the enemy was recorded.

The Spitfire R.9444 was delivered to the Royal Aircraft Establishment, Farnborough, on April 5th, 1940, and 18 days later went on to No. 6 Maintenance Unit, remaining there until June 14th when it joined No. 72 Sqn for operations.

It crash-landed on July 6th, 1940, after its pilot had lost control through lack of oxygen during an operational sortie at 20,000ft over the Cheviots. Coming to, the pilot found himself at 1,000ft, but managed to pull out and return to the airfield at Acklington, Northumberland. Subsequently, the aircraft was sent to Scottish Aviation, Ltd., and afterwards to various Maintenance Units, and still later served on several operational training units until 1944.

R.N.V.R. Promotions

THE promotion to the rank of commander (A) R.N.V.R. of the commanding officers of two air divisions of the Royal Naval Volunteer Reserve is announced by the Admiralty. They are Act. Cdr. (A) J. D. Murricane, M.B.E., D.S.C., of the Scottish Air Division at R.N. Air Station Abbotsinch and Act. Cdr. (A) B. W. Vigrass of the Midland Air Division based at Bramcote, Warwickshire.

New C.O. for No. 663 Squadron

ON December 16th, Major H. B. Warburton, M.C., M.B.E., D.F.C., R.A., took over command of No. 663 Air Observation Squadron at Hooton Park from Major C. Surgeon, R.A.

No. 663 Squadron was formed in Italy for duty with the Polish Forces operating under General Alexander, and this origin is commemorated in its badge, which shows a Polish eagle with a bit in its claws to signify control. The headquarters and two flights are at Hooton, one flight at Ringway, one at Castle Bromwich, and another at Cardiff. The squadron has distinguished itself by winning the Air O.P. Efficiency Trophy three years in succession.

Reunions

The next reunion dinner of the Old Comrades' Association of R.A.F. Stations Hurn, Harwell and Rivenhall, No. 38 Group and Airborne Forces, is being held at the Victoria Hotel, Buckingham Palace Road, London, S.W.1, on March 5th at 1900 hr. Tickets (£1) from Miss L. C. Waters, Ikoma, 14 Lynwood Grove, Orpington, Kent.

VIBRATION TESTING

—of Aircraft Gas Turbines: Some Useful Adaptations of Standard Instruments

THERE is a tendency—in which airline publicity agents have doubtless played an innocent part—to assume that the turbojet and turboprop are, by comparison with the piston engine, virtually vibrationless. The assumption is one that demands analysis. Very briefly, it can be said that, whereas the reciprocating action of piston engines leads to fairly high amplitudes of vibration, the comparatively low rotational speeds mean that the forces generated are not usually very large; the rotary motion of jet engines, on the other hand, results in a much lower amplitude of vibration but, due to the high rotational speeds, the associated forces are usually of a much higher order.

The more usual effects of vibration are well understood; and in aircraft practice provision is always made against the commonest of all, which is the tendency of nuts and screws and other threaded parts to work loose. Against some other effects—e.g., the tendency of metal to crack—there is little or no defence unless an impracticable weight of material is used. In any machinery, vibration tends to set up a vicious circle, the vibration causing wear and the wear in turn increasing the vibration.

In gas-turbine manufacture, vibration testing can be used to advantage in providing a rapid check on correct manufacture of individual components and on accurate assembly. An engine incorporating parts that are faulty in respect of dimensions, weight or fitting will seldom run smoothly, so that vibration test readings can be considered as a nominal criterion of quality of manufacture. The actual range over which readings may be expected to extend will, of course, be determined by the design of the engine. The point at which a particular engine falls within this range will, however, provide an excellent objective estimate of its general quality and of its performance in service.

To take such vibration readings, any one of several standard vibration meters now available may be used. The electronics laboratory which forms part of the instrument department of the Bristol Aeroplane Company's engine division has, however, suitably modified a large number of simple valve voltmeters. These are understood to be most effective for the limited duties for which they are intended.

Valve voltmeters are used at Filton for two main purposes. The first is the conventional one of setting up other testing equipment in the laboratory. The second is the rather unusual application of making vibration measurements on aircraft engines by using the voltmeters to measure the signals obtained from seismic vibration pick-ups.

This latter application again falls into two groups: first, research on new and development engines and, secondly, routine testing of established engines as they come away from the production line.

These three fields of operation require somewhat different characteristics from the instruments employed. The valve voltmeters used are, in fact, adaptations of the well-known Dawe Type 613 valve voltmeter but each is suitably modified for the purpose for which it is to be used.

For laboratory measurements involving other instruments, the obvious requirement is extreme sensitivity coupled, of course, with stability. This sensitivity is obtained by increasing the gain of the three-stage video amplifier employed in the Type 613 to give nine voltage ranges with full-scale sensitivities of 3mv, 10mv, 30mv, 0.1v, 0.3v, 1.0v, 3.0v, 10v and 30v. The resulting instrument, known as the Type 614 sensitive valve voltmeter, is directly calibrated down to a value of 100 microvolts on the lowest range.

A cathode follower is used before the amplifier for measurements up to the one-volt range so that the multiplier may operate at the low impedance level of the cathode circuit. Above one volt, a frequency-compensated divider direct on the high-impedance input is employed.

The large amount of negative feedback provided on the amplifier, together with the stabilized high-tension supply, renders the reading virtually independent of mains variation and of ageing of the valves.

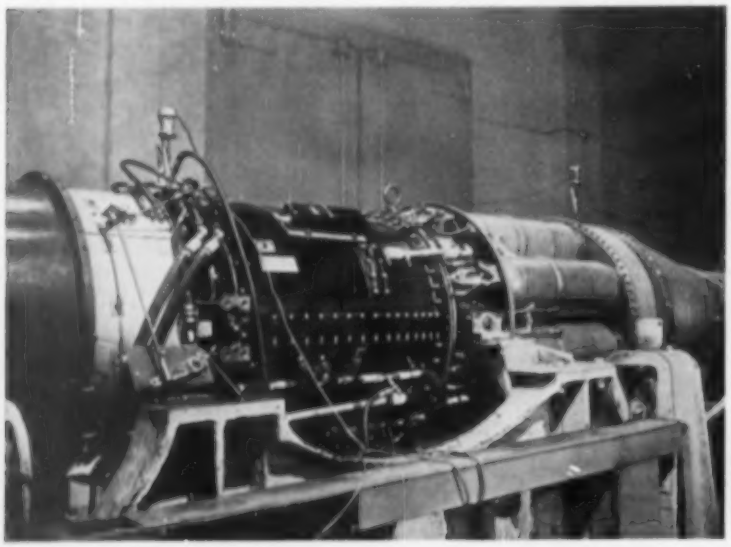
The miniature diode rectifier operates on a linear part of the characteristic so that the scale divisions on the meter are practically linearly spaced. This is an important feature when similar instruments are being used for routine production testing, as will be seen later.

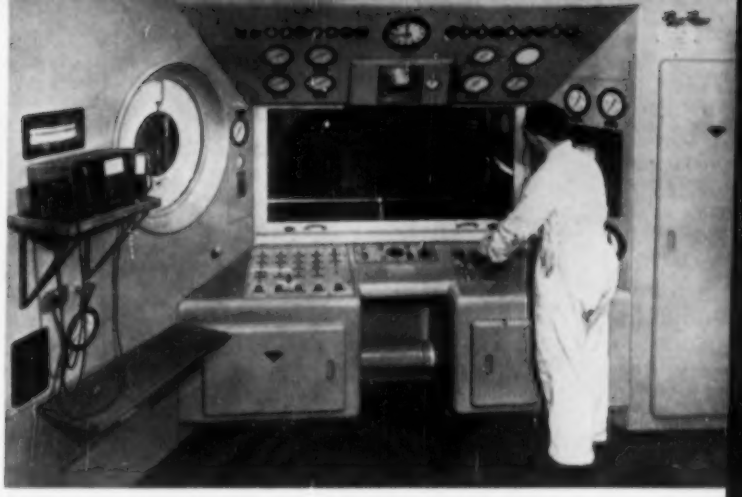
Another useful feature for such use is that the circuit is arranged to "limit" on large inputs. This means that the meter will not be damaged by occasional overloads of several hundred times the magnitude of normal inputs for the particular range.

This sensitivity renders the Type 614 very useful for calibrating and checking the frequency response of other instruments, valve voltmeters used on test beds, and varied equipment—specially produced by the instrument department for engine testing—such as filters and frequency-response instruments for vibration testing.

Slight modifications of the Type 614 voltmeter have also rendered it suitable for measuring vibration on research and development engines. These modifications are usually external to the

A 147 turbojet, from a Sabre, on test with Southern Instruments seismic vibration pick-ups clamped to compressor and turbine housings. (Right) This enlarged view shows how a pick-up can be readily attached to any part of an engine by adjustable-jaw self-locking pliers.





Dawe Type 614 sensitive valve voltmeter; note the linear scale. (Right) In this view of the control room of a Rolls-Royce turbojet test-house can be seen (on shelf at top left) a Dawe Type 613 valve voltmeter modified for routine vibration measurements on production engines.

instrument itself and include the addition of integrating circuits so that the valve voltmeter can act as a fault detector for unbalance in later stages of engine testing.

For all tests, ordinary seismic vibration pick-ups are mounted at critical points on the engine. Such pick-ups supply a voltage to the valve voltmeter which is directly proportional to the velocity of the vibrating surface of the engine. This is the reason for the introduction of an integrating circuit, since displacement (s) equals $\int V\,dt$ or $\int \frac{dv}{dt}\,dt$. By suitable calibration, which is referred to later, the instrument scale can be marked directly in peak-to-peak or r.m.s. displacement in thousandths of an inch. For research testing, however, the amplification of the instrument is deliberately varied from test to test so as to obtain the maximum sensitivity of reading. For this reason, changes of reading for different conditions are invariably recorded in such work.

Taking a typical research and development engine, such as the Olympus, measurements of change of vibration amplitude may well be taken, first, on the very-low-frequency vibration caused by turbulence in jet-pipes and by general slow movements in the engine mountings. Variation of the tuned circuits connected to the voltmeter would then permit study of the vibrations at much higher frequencies caused by the out-of-balance of the turbine or compressor.

For routine testing, further modifications are advisable, because for this type of work the instruments have a more restricted purpose and are used by less skilful personnel. All such instruments (at least one for every test bed) are calibrated directly in displacement in thousandths of an inch, a built-in integrating circuit being necessary for this purpose. The amplifier gain is also reduced slightly and the whole construction made sufficiently robust to ensure that it is very reliable for long periods under the severe vibration encountered on test runs.

For routine as well as for special vibration testing a number of vibration pick-ups are distributed round the engine. Particularly important points on turbojets are on the turbine and compressor casings. Pick-ups at these points will give a good idea of what is happening to the rotors.

The pick-ups are connected, in turn, to the modified Dawe valve voltmeter and the readings noted. From the results, a curve of rotor speed against vibration displacement is plotted at the beginning and end of the test period. A comparison of these curves will show at once any deterioration during the test run. Another good test of the quality of the engine is ensured by checking that at no point in the test does the vibration exceed a predetermined level considered acceptable at the particular operating speed.

The outstanding point about this set-up is that no zero adjustment of the meter is required; the operator has only to turn the selector switch and note the reading on the directly calibrated linear scale. Moreover, all the instruments described are based on standard designs, so that manufacturing costs are minimized and it is possible to add to the installation at short notice.

AUTO-NAV COMPUTERS FOR R.C.A.F.

TWO new automatic navigation computers have been developed in Canada for the R.C.A.F. One, called the R Theta computer, was designed by W/C. J. G. Wright, D.F.C., and developed and produced by P.S.C. Applied Research, Ltd., of Toronto. The other, called Position and Homing Indicator, is a more advanced version of the first and was developed by Computing Devices of Canada, Ltd., of Ottawa. Both are independent of radio and therefore cannot be jammed, and are light and compact. They will give the pilot of jet aircraft a course and distance to reach a selected point when, in the first computer, the pilot sets a desired position on the instrument, and, in the second, when he selects one of a series of preset points by pushing a button.

The R.C.A.F. has adopted the R Theta computer for service after 200 hours of air testing in various types of aircraft, and has handed the design over to the U.S.A.F. for comparative evaluation with a similar American device. Details have also been given to the R.A.F.

WORDS ON WEATHER

INTERNATIONALLY agreed changes in the surface and upper-air codes used in synoptic weather reports and aeronautical forecasts came into effect on January 1st. These changes, the first major ones of this nature since six years ago, were accompanied by some modifications in weather recording and the preparation of synoptic charts.

The revised *Handbook of Weather Messages*, published by H.M.S.O. for the Air Ministry Meteorological Office, comprises a complete guide to the current approved practices. A new feature of this second edition is its loose-leaf layout, enabling periodic amendments to be added.

Part one, in course of preparation, gives details of meteorological reports, forecasts, warnings, etc., issued by radio in the United Kingdom and from overseas. Part two, recently published at 4s 6d, lists the various codes and specifications used in compiling weather messages, and part three (in the press) contains instructions to observers on the use of the messages and codes. The whole publication is designed to serve as a concise reference book for observers at synoptic reporting stations.

The new codes and specifications relating to surface observations (land and sea) are also reproduced as an appendix to the second edition of *Instructions for the Preparation of Weather Maps* published by H.M.S.O. for the Meteorological Office at 1s 9d. This describes how to decode and plot surface weather messages, and is useful both for amateur meteorologists who receive the morse broadcasts from Dunstable and plot their own weather charts and for pilots and navigators who have to read weather charts plotted in the conventional symbols.

A copy of this new edition will be supplied as part of the present edition of *Meteorology for Aviators*, by R. C. Sutcliffe.

A more specialized aspect of meteorology is dealt with in *Geophysical Memoirs No. 93, Variation of Wind with Time and Distance*, by C. S. Durst, B.A. (H.M.S.O. for the Meteorological Office, 4s 6d). The author discusses the variation of upper wind with time and place, as calculated from the radio and radar wind ascents made in recent years. The treatment is by vector statistics.

FOR PRODUCTION EFFICIENCY

"Material Handling in Works Stores (The Fork Truck and Pallet System)," by L. J. Hoefkens. Published for "Mechanical Handling" by Iliffe and Sons, Ltd., Dorset House, Stamford Street, London, S.E.1. Illustrated. Price 18s (postage 6d).

OF particular interest to the managements of all but the smallest factories, this is the second edition of a book dealing with modern stores systems, with particular reference to the fork-lift truck and pallet technique. The emphasis is on the use of these systems in the medium and light engineering industries, and the author, who is stores controller in a large group of engineering companies, describes in practical terms the results of introducing the new techniques to a particular plant; he traces the progress of the products from the raw material stage to the finished article.

THE INDUSTRY

Special-purpose Pneumatic Tools

A RANGE of pneumatic tools coming into increasingly widespread use in the aircraft industry is that made by the Atlas Diesel Co., Ltd., of Wembley, Middlesex. Established over 30 years ago as part of a world-wide organization with headquarters in Stockholm, the company disposed of their diesel engine interests in 1948 and have since specialized entirely in compressed-air industrial equipment.

Among Atlas portable tools are small riveting hammers, the newest of which is a long-stroke, slow-hitting hammer designed specially for use with high-tensile light alloy rivets. Piston strokes range from 4in to 6½in and hammers are available giving a blow frequency of 1,450 to 1,100 per minute. It is stated that rivets of up to ⅜in diameter can be closed by these tools without risk of splitting. If required, a built-in regulator can be provided whereby the intensity of the blow can be adjusted. Total weight of the tool is 5 lb and overall length 10⅛in.

Other tools include a range of air drills, among which are two low-speed drills for use on special alloy steels. With capacities of ⅜in and ¼in, these tools have running speeds of 1,700 and 1,250 r.p.m. respectively, the full-load speeds being between about 75 per cent. of these figures. Another Atlas portable drill is a light-weight type with a capacity of up to ¼in in mild steel; it is of particularly compact design, so that it can be used in confined spaces.

Atlas pneumatically-operated equipment includes fixed and portable grinders of various types, valve grinders, impact wrenches, chipping hammers, and hoists. Operated by reversible vane-type motors, the air hoists—weighing 56 lb and designed to replace hand tackles—give particularly precise control of lift.

Fuel-system Relief Valves

FOR some years past, the Hymatic Engineering Co., Ltd., of Redditch, Worcs., have been designing and making special-purpose valves for aircraft fuel systems and other pressure installations. They have recently announced a new series of valves designed to maintain a constant differential between ambient and fuel tank pressures at varying altitudes.

These combined relief and vent valves are typified by the RV22, which consists of two valves working in opposition and so arranged that the airflow in either direction by-passes one valve and is pressure-relieved by the other. Positive pressure relief is through a spring-loaded poppet valve which maintains the tank pressure to within plus or minus 0.5 lb/sq in of the nominal setting for flows up to 12 cu ft/min free air, whilst inward venting is through an extremely sensitive diaphragm valve. It is stated that a pressure differential of only 0.05 lb/sq. in is required to initiate inward venting, yet perfect sealing is maintained.

An 80-mesh gauze that can be easily withdrawn for cleaning is incorporated to protect the valve seats and prevent entry of foreign matter into the tank. Relief pressure is normally adjustable from 4 to 5.7 lb/sq in, and the unit will function within a temperature range of 70 deg C to −30 deg C.

When the RV22 is used for its standard duty of relieving excessive pressures during a climb and venting inwards, to prevent tank collapse, a smaller reducing valve may be used for fuel-tank pressurization on those installations where the valve caters for engine fuel-consumption only.

Constructed chiefly from light alloy, with sealing members of synthetic rubber resistant to aircraft fuels, the RV22 weighs 0.68 lb. Overall dimensions are 3.84in high by 3in in diameter.

IN BRIEF

Mr. R. B. Pullin, O.B.E., chairman of R. B. Pullin and Co., Ltd., and Mr. P. J. Ellis, O.B.E., managing director, were due to leave London Airport last Tuesday, January 11th, for the U.S.A. They are visiting New York, Chicago and Los Angeles in connection with the company's current extensions of activities. They will sail for home on January 26th.

* * *

Previously assistant general works manager to Rolls-Royce, Ltd. aero division (Derby), Mr. C. C. Birch has joined Guest, Keen and Nettlefolds (Midlands), Ltd., as general works manager of their screw division.

* * *

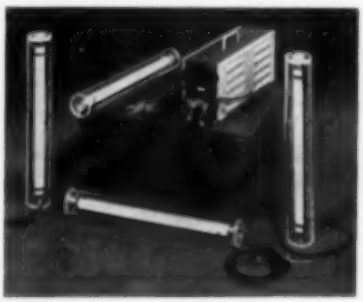
W/C. S. J. Field, O.B.E., joins I.V. Pressure Controllers, Ltd., on February 1st as aircraft sales manager. He has had over 34 years' service with the R.A.F.; during the war he was twice Mentioned in Dispatches, and was appointed O.B.E. during service with the 2nd Tactical Air Force in 1943-45. He was subsequently on the staff of the R.A.F. Technical College and has recently completed an Air Ministry appointment in the Directorate of Aircraft Engineering.

W/C. S. J. Field

Mr. David Leighton Davies, B.Sc. (Hons.), G.I.E.E., has been appointed chief electronic engineer of Winston Electronics, Ltd., of Hampton Hill, Middlesex. He was responsible for the design and development of the guided missile pre-launch test gear referred to on page 26 of *Flight* last week. Before joining the firm a year ago, Mr. Davies was engaged on guided-missile work with English Electric.

* * *

Mr. Eric Dymond, A.M.I.Mech.E., A.M.I.E.E., A.F.R.Ae.S., who resigned from the Board of Sangamo Weston, Ltd., some two years ago after 28 years with the company, leaves England tomorrow, January 15th, for a tour of North America. Mr. Dymond, who retains his chairmanships of Two-Way Talkie, Ltd., and Neltic, Ltd., is acting in a technical advisory capacity with various companies. His forwarding address is: c/o Bankers Trust Company, 455 Park Avenue at 57th Street, New York City.



These new Atlas portable fluorescent lights consist of 2ft 40 W tubes enclosed in Perspex cylinders; on a 110 v 50 c.p.s. supply the tube potential is only 50 v. Several aircraft manufacturers are already using them in fuselage assembly work. (Thorn Electrical Industries, Ltd., 105-109 Judd Street, London, W.C.1.)

Associated in various capacities with the publicity side of the Hunting and Hunting-Clan Group of companies for the past seven years, Prince Yurka Galitzine has resigned in order to form his own company, to be known as Galitzine and Partners, international public relations consultants; their temporary business address is 59 Egerton Gardens, London, S.W.3 (Kensington 7151).

* * *

Following the retirement of Mr. P. A. Andrew from Export Packing Service, Ltd., for health reasons, Mr. R. T. Hill, A.M.Inst.T., has been appointed to succeed him as sales director, with headquarters at the company's London office at 56, Kingsway, W.C.2. He has been senior general works manager since 1950. During the war he was twice Mentioned in Dispatches for his services in organizing supplies and transport in Sicily and Italy.

Mr. R. T. Hill

We regret to learn of the death, on January 3rd, of Mr. William Ogilvie, technical director of B.S.A. Tools, Ltd. He joined the B.S.A. Group in 1910.

* * *

Northern Aluminium Co., Ltd., have moved their Birmingham area sales office to 14 Bennetts Hill, Birmingham, 2. The office remains under the management of Mr. G. H. Vernon.

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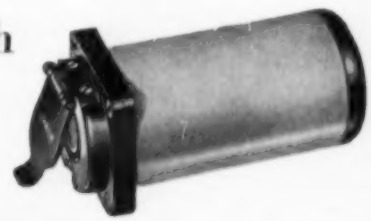

This switch is designed to operate, in conjunction with the starting time switches, the multi-breech cartridge starting installations on gas turbine engines.

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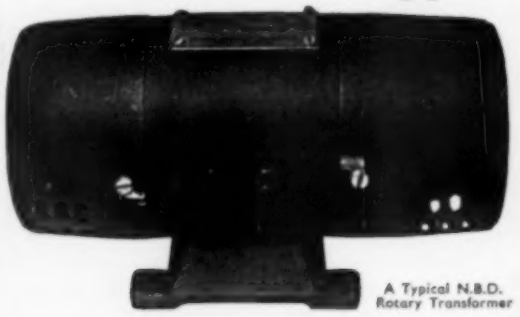

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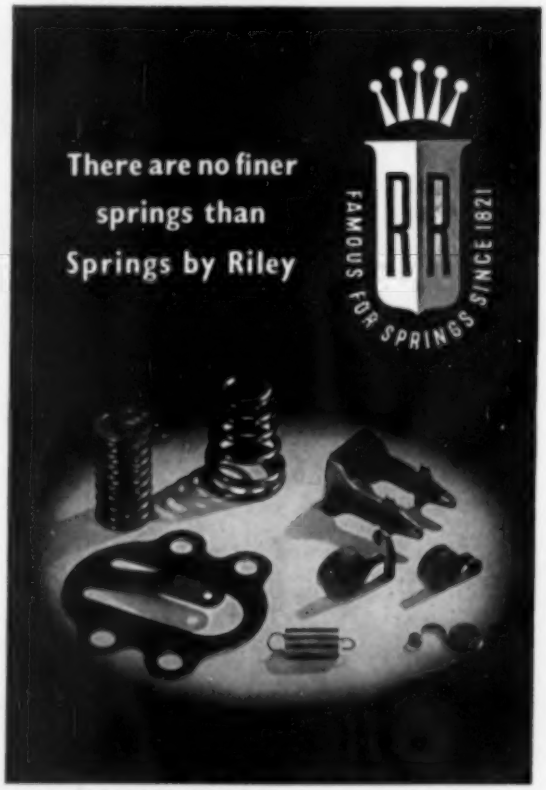

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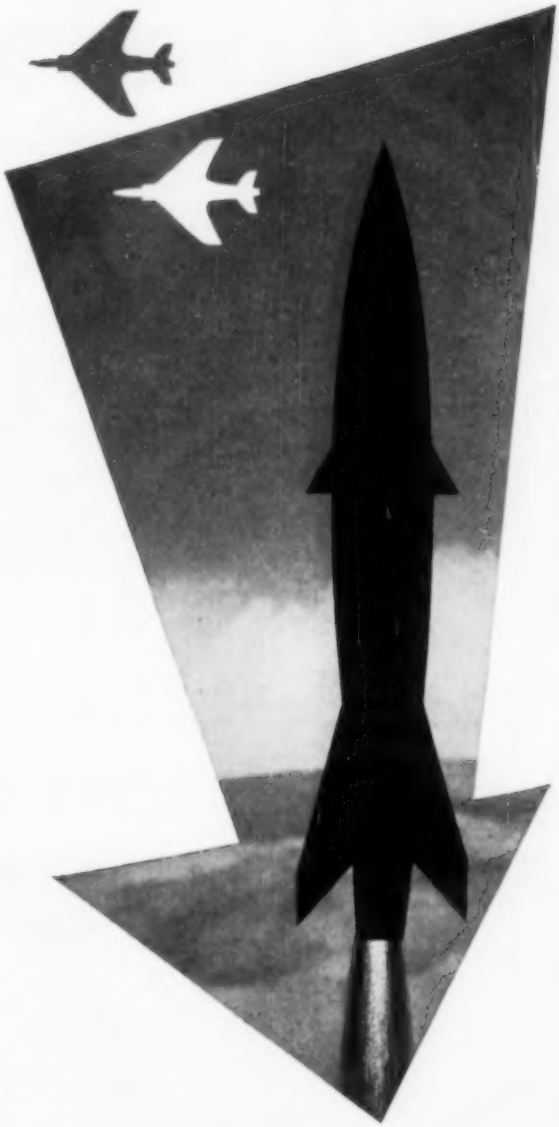

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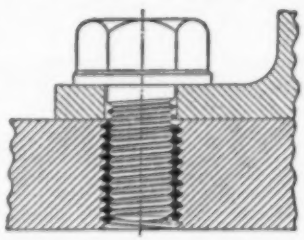

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PUBLIC ANNOUNCEMENTS

AIR TRANSPORT ADVISORY COUNCIL

THE Air Transport Advisory Council give notice that they have received the undermentioned applications to operate Scheduled Air Services:—

FROM Dragon Airways, Ltd., Speke Airport, Liverpool, 19:—

APPLICATION No. 307/1 for permission to use D.H. Heron aircraft in addition to the aircraft types already authorised on the Internal Service on the route Liverpool (Speke)-Glasgow (Renfrew) via Prestwick (optional stop), which has been approved by the Minister of Transport and Civil Aviation for operation during the period up to 28th February, 1962, at a frequency of from two to seven return flights weekly.

APPLICATION No. 444 for a Normal Scheduled Service for the carriage of passengers, supplementary freight and mail to be operated with D.H. Heron aircraft between Liverpool (Speke) and Amsterdam (Schiphol), at a frequency of two return flights per week, for a period of seven years, commencing 4th April, 1955.

APPLICATION No. 445 for an Internal Service for the carriage of passengers, supplementary freight and mail between Liverpool (Speke) and London (Croydon), with the right to make an optional stop at London Airport, to be operated with D.H. Heron aircraft, at a frequency of from five to 14 return services weekly, for a period of seven years, commencing 6th June, 1955.

APPLICATION No. 446 from Hunting-Clan Air Transport, Ltd., of 5, Fitzhardinge Street, Portman Square, London, W.1, for an Inclusive Tour Service for the carriage of passengers, in conjunction with the Fifty-One Club, between Glasgow (Renfrew) and Munich, to be operated with Dakota and/or Viking aircraft, at a frequency of eight return flights during the period from 5th June to 11th September, 1955.

THESE applications will be considered by the Council under the Terms of Reference issued to them by the Minister of Civil Aviation on 30th July, 1952. Any representations or objections with regard to these applications must be made in writing, stating the reasons, and must reach the Council within 14 days of the date of this advertisement, addressed to the Secretary, Air Transport Advisory Council, 3, Dean's Yard, London, S.W.1, from whom further details of the applications may be obtained. When an objection is made to an application by another air transport company on the grounds that they are applying to operate the route or part of route in question, their application, if not already submitted to the Council, should reach them within the period allowed for the making of representations or objections. [3140

PUBLIC APPOINTMENTS

FEDERATION OF RHODESIA AND NYASALAND

Department of Civil Aviation: Vacancies: Inspectors of Aircraft

APPLICANTS, preferably under 35 (but not over 45) should hold Cats. A, B, and C (or A, C, and D) of the aircraft maintenance engineers' licence. (Applicants licensed in A and C only considered if experience specially relevant.) A minimum of 5 years' post-training experience of maintenance, overhaul and repair of airframes and aero engines required.

COMMENCING salary £1,400 on scale rising to £1,550.

APPLICATION forms and further details from the Secretary, Rhodesia House, 429, Strand, London, W.C.2. Completed forms to be returned by January 31. [3081

MINISTRY OF SUPPLY requires engineer in London Headquarters to assist in standardisation of aircraft mechanical and structural parts, involving visits, correspondence, committee and liaison work, arranging trials and evaluating results. British of British parents. Recognised engineering apprenticeship and A.F.R.Ae.S. or A.M.I.C.E. or Mech.E. or E.E. or exempting qualifications. Wide experience in preparing technical reports; much practical experience, preferably in manufacture, maintenance or inspection of aircraft or equipment to M.o.S. requirements. Salary: Within £1,035—£1,355. Not established but opportunities to compete for establishment may arise. Application forms from M.I.N.S., Technical and Scientific Register (K), 26 King Street, London, S.W.1, quoting Ref. No. C906/54A. Closing date 4th February, 1955. [3138

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FOR details of these and other courses, apply to.—The Commandant, Air Service Training, Ltd., Hamble, Southampton. [0970

SITUATIONS VACANT

AMBITIOUS TECHNICIANS

SUCCESSFUL applicants for the following vacancies will join a team already well established in the rapidly expanding field of guided missiles design and development. Every opportunity will be given to become familiar with the new techniques associated with this interesting work and rapid progress can be made by those displaying initiative and ability.

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STRESSMEN (Ref. F./18), with several years' experience of aircraft or missile stressing. Emphasis is placed upon structural and functional testing in support of design calculations.

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ASSISTANT chief buyer required by progressive firm of Aircraft Designers and Manufacturers. Considerable experience in aircraft industry, and knowledge of usual material specifications essential, preferably with general light engineering background. Good organiser and able to act on own initiative. Full welfare facilities, including staff pension scheme.—Applications, stating age, experience, qualifications and salary required, to Personnel Manager, Box 08900. [3100

SITUATIONS VACANT

IF you have aircraft design experience and would like to explore the possibilities of working and living on the Isle of Wight, you have only to send a postcard for an application form to the address below.

WE would be pleased to hear from anyone qualified for employment in any of the following capacities:—
DRAUGHTSMAN
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WE are able to offer assistance with accommodation, participation in pension and assurance schemes and a salary in accordance with experience and qualifications.
THE PERSONNEL DEPT. (Ref. F/19),
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EAST COWES, I.o.W. [3035

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ARMSTRONG SIDDELEY has vacancies for:—
(1) Technical assistants in the departments of vibration, structural testing, balancing and engine test recording.
(2) Two engineers for electronic section.
(3) Design draughtsmen for design work.
(4) Instrument work on strain gauges. Dexterity with fingers essential.

APPLICANTS should have at least a higher National Certificate in Mechanical Engineering for (1) and Electrical Engineering for (2). Salary and prospects good.—Apply to Reference CG/ME5, Technical Personnel Manager, Armstrong Siddeley Motors, Coventry. [3135

A RAPIDLY expanding Instrument Firm with new projects in the aircraft control field requires:
ELECTRICAL AND ELECTRO MECHANICAL ENGINEERS
with experience of any of the following subjects:
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(b) Analysis of control systems.
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(d) Analogue computers.
(e) Gyroscopic devices.

PLEASE apply in writing, giving full particulars of career, to: Personnel Officer, Louis Newmark, Ltd., Prefect Works, Purley Way, Croydon. [3117

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The Bristol Aeroplane Company Limited is centralising its London Aircraft Design Offices in Haymarket House, Haymarket, London, S.W.1, and is expanding its design team.

A unique opportunity is offered to experienced draughtsmen, technicians and loftsmen to join design teams engaged upon Civil and Military Aircraft contracts, in both the fixed wing and rotating wing fields.

A progressive CAREER is offered, where ABILITY merits RAPID PROMOTION; where the FINEST WORKING CONDITIONS are being built up in the most CENTRAL POSITION IN LONDON, where SALARIES are appropriate to experience and qualifications, and where a contributory PENSION SCHEME ensures the FUTURE.

The following are required:—
(a) **Intermediate, Senior and Design Draughtsmen** for the Structures, Systems, Electrics and Mechanical Sections. Some Juniors may be considered for training.
(b) **Intermediate and Senior Loftsmen** for the aircraft Full Scale Layout Section.
(c) **Intermediate and Senior Technical Engineers** for the Structures Analysis and Aeroelasticity Sections. A degree or Higher National Certificate in Aeronautical, Mechanical or Structural Engineering is required.
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Applications, giving details of experience, qualifications, quoting L.D.O.1, should be addressed to the **Design Administration Engineer, The Bristol Aeroplane Company Limited, Aircraft Division, Filton House, Filton, Bristol.** Interviews can be arranged either in London or Filton.

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Applications invited for pensionable appointments on the Senior Staff of the Design Office. Applicants should be well qualified men with the experience and designing ability to justify the payment of good commencing salaries. Please write fully, stating salary expected, in first instance, to The Personnel Supervisor.

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WORK on high efficiency light alloy structures. Good knowledge of materials and manufacturing technique essential. Ref. D.1.

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LIGHT mechanical work associated with aircraft structures and installation of special components. Knowledge of electrical or hydraulic systems an advantage. Ref. D.2.

THESE positions carry attractive salaries and promotion prospects; and are pensionable after qualifying period. Housing assistance can be given in some cases. Applications to Dept. C.P.S., 336/7, Strand, W.C.2, quoting appropriate paragraph number and Ref. 1119M. [3092

THE COLLEGE OF AERONAUTICS

A VACANCY exists in the Department of Flight for a Research Project Technician, on contract work. He will be responsible for investigation of boundary layer conditions in flight on a specially modified Lancaster aircraft. Good scientific background and sound knowledge of aerodynamics essential. Experience of flight research desirable. Successful applicant to assist in expanding programme of full-scale aerodynamic research. Salary according to qualifications and experience. Single accommodation available.—Applications to Recorder, The College of Aeronautics, Cranfield, Bletchley, Bucks. [3120

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DEMONSTRATOR required in the Department of Flight. Essential requirements are a good scientific background and experience of modern flight-testing methods and analysis of results. Applicants must be physically fit and willing to fly as observer. Salary within range £400 to £700 p.a., extending by annual increments to £800 p.a., with superannuation under F.S.S.U., and family allowance, and full flying insurance.—Applications, giving full particulars, to the Recorder, The College of Aeronautics, Cranfield, Bletchley, Bucks. Further particulars available. [3121

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SENIOR and Junior Stressmen vacancies for interesting programme of project and development work. Previous experience not essential for junior posts. H.N.C. minimum qualification. Salary in accordance with experience and qualifications.—Full particulars in writing to Personnel Manager, Flight Refuelling, Ltd., Tarrant Rushton Airfield, nr. Blandford, Dorset. [3137

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PRODUCTION ENGINEER

Experience on repair of Service aircraft essential.

Good prospects, progressive salary and pension scheme.

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GOOD SALARIES and excellent opportunities.

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FOR further information, apply in writing, giving full details of qualifications, experience, age and marital status, to:—

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TECHNICAL authors are required for the preparation of descriptive and servicing manuals, servicing schedules, pilots' notes, etc. Candidates should have had experience of aircraft servicing and maintenance and special consideration will be given to ex-R.A.F. personnel. Applications are particularly required from men with electrical experience.

APPLICATIONS, giving full details of age, qualifications and experience, also salary required, should be addressed to the Labour Manager, A. V. Roe & Company, Limited, Greengate, Middleton, Manchester. [3072

PROJECT engineers for installation engineering of:
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IN addition to technical liaison with customers and operators.

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CHIEF stressman, with good aircraft structural experience, required for super priority work by old established firm on South Coast.—Apply Box 0694. [3037

ARMSTRONG SIDDELEY MOTORS has vacancies for technical assistants in their main engine development department. The work deals with the development of all types of the company's aero engines from their earliest inception. Higher National Certificate in Mechanical Engineering essential. Prospects and salary good in this expanding department.—Apply, quoting Reference CG/X1, Technical Personnel Manager, Armstrong Siddeley Motors, Coventry. [3134

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Companies are engaged upon long-term projects relating to aircraft propellers, landing gear, auxiliary gearboxes, bleed and ram air turbines, hydraulic and electro-hydraulic devices, servo-mechanisms, and fuel flow proportioners.

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Applications should be addressed to the

Personnel Manager, Messrs. Rotol/British Messier, Ltd., Cheltenham Road, Gloucester.

SITUATIONS VACANT

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(b) An instructor/electrical is required for lecturing on aircraft electrics. Applicants should have served an apprenticeship as an electrician and have a knowledge of A.C. as well as D.C. Preference will be given to those having aircraft experience (including A/C instruments) and also to those who have done some instructing previously.

APPLICATIONS, giving full details of age, experience and qualifications, also salary required, should be addressed to the Labour Manager, A. V. Roe & Co., Ltd., Greengate, Middleton, Manchester. [3031

SENIOR and junior draughtsmen required for interesting work on remote control for aircraft and atomic equipment.—Apply in writing to Teleflex Products, Ltd., High Road, Chadwell Heath, Essex. [0720

STRESSMAN of good junior or intermediate standard, with 3-4 years' aircraft experience, required for interesting work on new project.—Apply, in writing, to F. G. Miles, Ltd., Shoreham Airport, Sussex. [3095

HOUSING assistance will be offered to senior draughtsman required for work on small section. Experience of aircraft ancillary equipment design required. Knowledge of small turbines and solid propellants an advantage. Company situated in pleasant country surroundings, one hour west of London.—Please apply, giving details of age, past experience, qualifications, married/single, present salary, salary required, to Box 1077. [3143

ARMSTRONG SIDDELEY MOTORS require senior draughtsmen for the design of special handling equipment for the manufacture of gas turbine engines and rocket motors. Position carries close liaison with the Services and airframe manufacturers. Applicants should be able to direct and co-ordinate the work of others. Junior draughtsmen are also required for detail work on the above. The company is expanding and the initial salary is good and prospects for the right men are excellent.—Apply to Reference CG/SD2, Technical Personnel Manager, Armstrong Siddeley Motors, Coventry. [3136

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The following vacancies occur at our Maintenance Base at

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A. **SKILLED AIRFRAME FITTERS**
experienced on Bristol Freighters and Hermes aircraft essential.

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with experience on Bristol Hercules engines.

C. **SKILLED ELECTRICIANS**
experienced on Hermes aircraft preferred.

D. **INSTRUMENT MAKERS**
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E **RADIO MECHANICS**
skilled repair and maintenance.

F. **INSPECTION**
Airframe, Engine and Electrical Inspectors, preferably licensed or experienced on Hermes or Bristol 170 aircraft.

Applications should be made to

PERSONNEL OFFICE
FERRY AIRPORTS LIMITED
BLACKBUSHE AIRPORT
CAMBERLEY, SURREY

GLOSTER AIRCRAFT CO. LTD.
GLOUCESTER

HAVE VACANCIES ON SUPER-PRIORITY DESIGN AND DEVELOPMENT PROJECTS

FOR

AIRCRAFT

DESIGN DRAUGHTSMEN
(SENIOR & JUNIOR)

Consideration will also be given to Draughtsmen with Mechanical, Structural or Electrical experience.

Also

STRESSMEN
(SENIOR & INTERMEDIATE)
for both strength and flutter calculations.

The conditions of employment are good with progressive salary, good sports and welfare facilities, pension scheme, etc.

APPLICATIONS STATING AGE, PREVIOUS EXPERIENCE AND EMPLOYERS SHOULD BE ADDRESSED TO THE

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SITUATIONS VACANT

AIRCRAFT inspectors required for details, major assemblies, final erection and flight shed work. Good pay and prospects for suitable men.—Apply stating age and particulars of experience to: Personnel Officer, Hawker Aircraft (Blackpool) Ltd., South Shore, Blackpool. [3112

INSPECTOR for senior position required by well established manufacturers of aircraft components. Good opportunity for capable man with ambition. Knowledge of A.I.D. procedure an advantage. Write, Secretary, Delaney Gallay, Ltd., Vulcan Works, Edgware Road, Cricklewood, N.W.2. [3126

TECHNICAL staff wanted: Experienced man capable taking charge complete aircraft project; minimum seven years' senior stressing. Also, several intermediates; minimum five years' good technical office experience. Good opportunity in financially sound aircraft manufacturing company, London area.—Reply fully, training, experience, salary required. Box 1054. [3132

RADIO Officers are required to serve with British International Airlines, Ltd., Kuwait, Persian Gulf (a subsidiary of B.O.A.C.). Applicants must hold current first-class Radio Telegraphy Operator's licence. Basic salary of £725 p.a. plus £200 p.a. single or £250 p.a. married overseas allowance, plus Rs.829 per month, free of Income Tax. Furnished single accommodation provided, for which a nominal charge is made. Married accommodation not at the moment available. Free medical service and insurance is arranged and generous home leave is given with free passages to and from U.K.—Applications in writing to Staff Manager, Subsidiaries, B.O.A.C., Airways House, Great West Road, Brentford, Middx. [3123

CERTIFIED engineer required for partnership in the north of England. Sale, maintenance, conversion and Cs. of A. for Geminis, Proctors, Rapides, etc. Capital and workshop available. Small capital required. —Box 0823. [3075

MINISTRY OF SUPPLY requires craftsmen to serve as research and experimental mechanics (special) for electronic work at Boscombe Down. Applicants must have served a recognised apprenticeship or have had equivalent experience and must be able to read and interpret schematic wiring diagrams of electronic equipment, and have ability to lay out, assemble and wire panels for electronic test apparatus from rough sketches and verbal instructions.

THEY should also be familiar with the operations and servicing of standard commercial units, oscilloscopes, valve voltmeters and amplifiers, etc.

RATE of pay for 44-hour 5-day week 147/10+26/- merit lead on entry, with prospects of increase in merit lead in 1-3 months.

APPLY, giving details of apprenticeship, training (including Forces' training), qualifications and experience, to "Air Commodore Commanding, Aeroplane and Armament Experimental Establishment, Boscombe Down, Wiltshire. [3139

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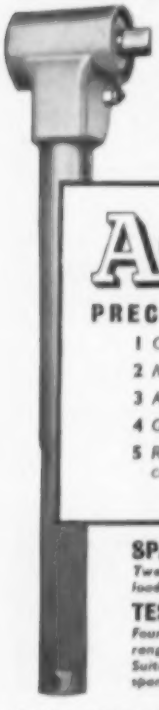

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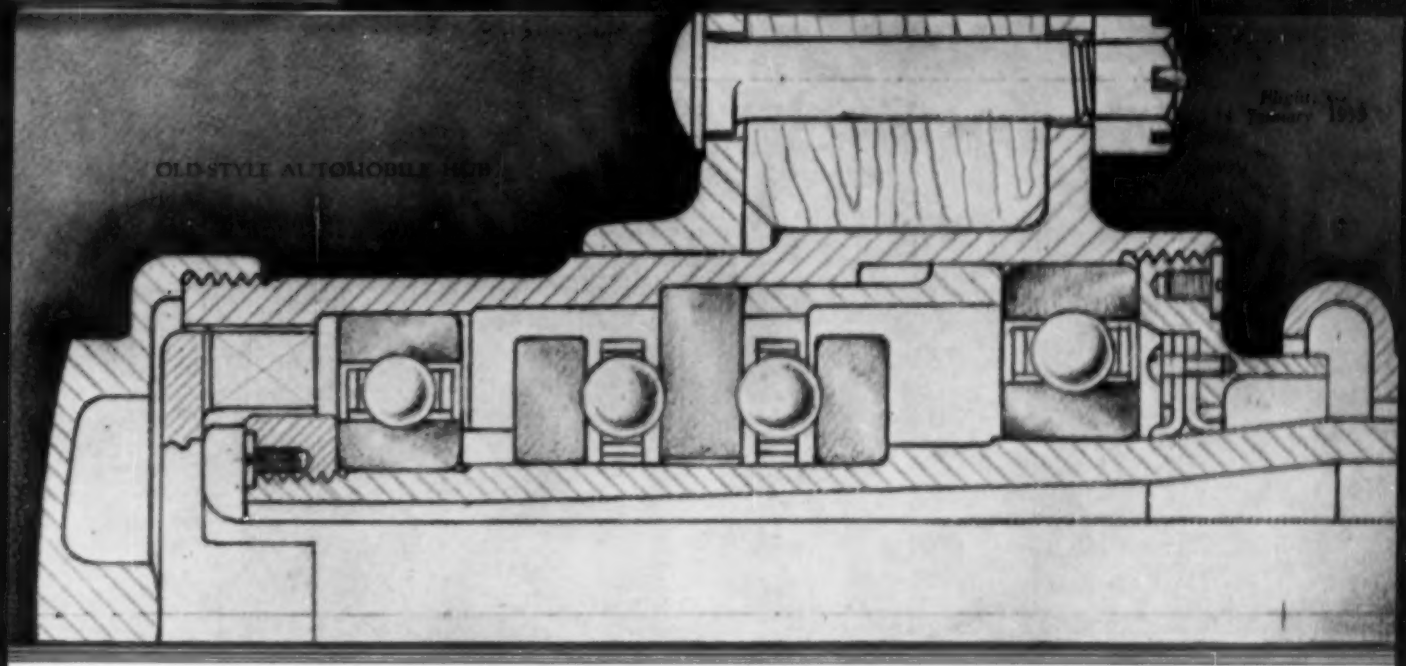

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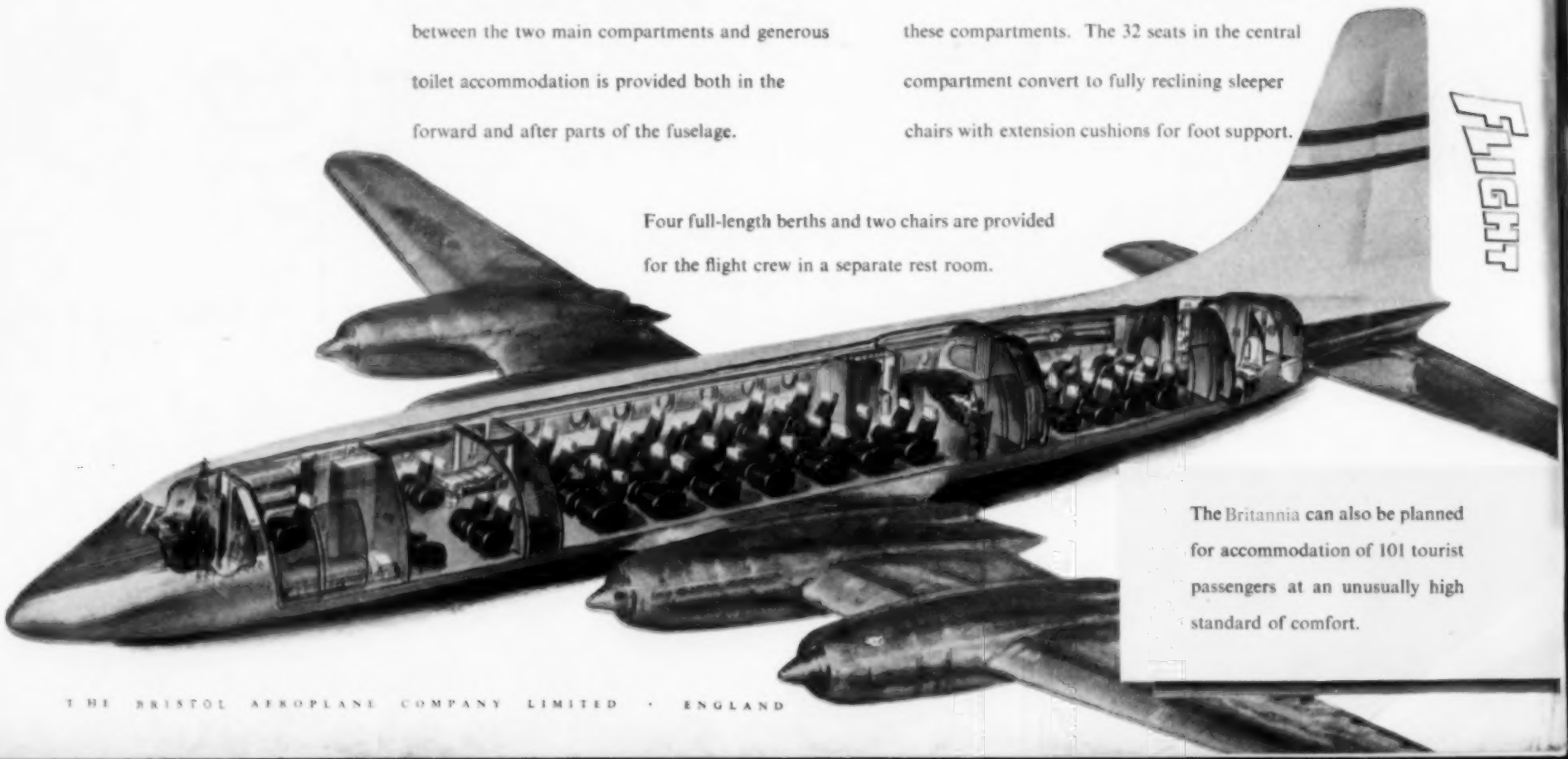

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